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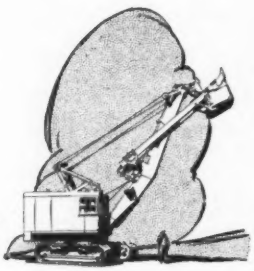
REVIVE THE CONST
and put millions



Why not!

Construction and its associated industries in normal times do a business of nearly eight billion dollars. They directly employ over three million men and 91 cents of every construction dollar is paid directly or indirectly for wages.

—here is a group of wage earners that is a nation in itself!

—here is a vast purchasing power—a market that, if, by well directed aid is put in position to buy, will carry the country over the hump!

NORTHWEST

Engineering News-Record

New York, May 18, 1933

Volume 110 Number 20

F. E. SCHMITT, *Editor*

An issue devoted to

PUBLIC-WORKS CONSTRUCTION

The contents of this issue have been planned as a manual of information for those citizens and public officials who, by furthering the immediate construction of public works, can contribute to re-employment and business recovery.

◆

The Right Road to Recovery

THE SANE AND SENSIBLE plan of the government for undertaking a large public-works program as a means of re-employing a considerable number of the thirteen million idle workers represents the right course to recovery. Though it comes late, it is admirably timed to coordinate with current developments. Its necessity was apparent more than a year ago and its curative effect then would have been more rapid; conditions now are much worse—unemployment exceeds one-fourth of all workers. But for this very reason it is more compellingly necessary and its results are potentially greater.

What the government proposes is to rebuild the shattered economic structure by deliberate attack on unemployment, using public-works construction as the best means available. This step logically follows and supplements the steps which the government took in March to rehabilitate the banking and monetary systems and achieve governmental economy. The earlier steps, however necessary, were purely negative; the present plan is positive, aggressive.

For these reasons the move is epoch-making, both in its relation to the depression emergency and in its long-time meaning. It represents a profound change from the traditional views on economic, social and political matters, the essence of which is recognition that business activity and employment are no longer the affair of the individual alone but concern the entire body politic.

That the courageous program may be assured of fullest success it must be mobilized with utmost speed, a result that is possible only with the whole-hearted cooperation of the local governments, since their deferred local improvements are bound to furnish the largest part of the immediately ready work. In order that this cooperation may be based on full understanding, the present issue of *Engineering News-Record* is designed to provide essential information on the meaning and influence of public-works construction. It presents authoritative facts and studies that throw light on the relation of such construction operations to the recovery of general business, to credit, to the taxpayer and to the community.

IT IS worth recalling what led up to the government's plan. The principle that the depression must be broken by re-employment and that this can be done only through public construction has been in the public eye for nearly two years. But a long fight was necessary before it could win official recognition. Tradition was against it, as well as ignorance and self-interest. Tradition opposed governmental action and favored

reliance on the self-restoring power of individual initiative. Ignorance caused public works to be denounced as waste, and denied the corrective power of public construction and its life-giving effect on credit. Self-interest attacked re-employment by government action as interference with the process of liquidation, claimed to be the necessary if painful corrective of economic error. All appreciation is due those who fought this opposition and stood steadfast for constructive action to save the country's manpower and industrial organization from the destruction that was being wrought by deflation and unemployment.

EVEN a year ago the opposition was strong enough to defeat all effective measures for re-employment. It succeeded in limiting action to a provision for financing projects that were euphemistically called "self-liquidating." Weak in its very nature, this enactment was further condemned to failure by narrow administrative methods. It failed to create employment, and it allowed the disintegrating processes to continue unchecked, up to the near-catastrophe of the early days of March. Events finally made it clear that spontaneous recovery would be too slow and would entail dangers too great to contemplate with equanimity. Recognition of that truth is inherent in the government's plan, which declares, in effect, that individual effort to counteract unemployment has failed and that direct national action is therefore necessary.

Thus the plan acknowledges employment as the key to business recovery. Precisely this point was at the heart of the controversies of the past two years. According to conventional doctrine, unemployment was merely a regrettable incident of economic readjustment, something that could not be avoided and that would correct itself as soon as the readjustment was ended. Those who saw the effects of unemployment denied this doctrine, and so the issue was whether employment must wait on industrial revival or the latter wait on the purchasing power of the re-employed wage earner. The hard logic of fact decided this issue. When it was realized that the economic system under which we live today rests on mass welfare and solvency, and that without employment there would be no need for banks and corporations or even a monetary system, re-employment was at last accepted as basic. Still more slowly came acceptance of the fact that public-works construction offers the only large opportunity for creating employment, and that, if this opportunity cannot be utilized otherwise than by national action, such action is imperative. This, in brief outline, is the background of the government's plan.

WHAT kind of public works are to be the backbone of the program? Projects that envision new conceptions of gigantic size, such as a trans-continental superhighway, are obviously unworkable and unnecessary. It was shown a year ago that deferred normal improvements of states, cities and counties represented 1½ billions of dollars, and that resuming the normal programs would provide direct employment for more than a million men. The amount of undone improvement work having increased greatly since then, little more is needed than to draw upon this huge reservoir of projects. In addition, the deferred highway construction represents a formidable total of widely distributed construction operations, which have the decisive merit that they can be put under way at once.

The public-works proposals of last spring were made under more favorable financial conditions than the present. At that time little more was needed than government financing of the local projects. Today, when the treasuries of cities and states are empty, when operating expenses are hard to meet and borrowing power is destroyed, more forceful procedure is necessary. For, obviously, the speed with which the plan can be put into action is the supreme consideration; re-employment through active construction is now a race against time.

One objective is to bring out all the deferred improvement works of local governments and see that the engineering plans are completed to the contract stage. A second objective, even more immediate, is to rally the state highway organizations for prompt completion of contract plans for all the highway work that the allotted amount will permit. As already indicated, the highway work is the most readily available source of large-scale employment and, if a definite allocation is made so that projects can be selected at once, most of it can be placed under contract immediately the bill is enacted.

OF the many questions and doubts that have surrounded public-works employment proposals, certain ones are outstanding. Because the scope and service of public works have been largely misunderstood, they have been looked on as extravagance in a time when rigid economy is essential. When it is realized that public works are service facilities of highly diversified kind that make industry fruitful, many current doubts of the wisdom of public-works construction will disappear. The same is true of the charge that we have too many public improvements. Well-informed writers in the present issue bring out the true conditions.

Most important is the fact that construction lies at the heart of business life. It is this that makes it so potent a force in the revival of trade and industry, toward which the present campaign is directed. Studies are presented that bring out its far-reaching extent and the multiplying effect of the construction dollar in creating other production, commerce and services.

Finally, and from the long-time view most important, the much mooted subject of business stabilization is presented for consideration, since it has acquired sensationally new importance in the light of recent history. That public-works construction is a potential stabilizing force has long been recognized, and now that the nation is engaging in an emergency stabilizing operation of vast size these possibilities come into prominence.

ADOPTION of the government's plan means definite departure from the charity-relief philosophy that has held our public life in its grip for the past few years. The plan is socially constructive, in so far as it gives first consideration to the unemployed worker and restores him to his rank as an independent wage-earner. But its real objective is the restoration of business life by establishing normal purchasing power and thereby setting in motion the whole train of trade and manufacture dependent thereon.

In its very essence, then, the public-works plan is removed from stop-gap relief purposes and devices. Regimented squads of welfare workers have no place in its functioning; instead, resumption of the normal processes of trade and employment is its basic reliance. Success will be dependent upon courageous and clear-sighted adherence to this fundamental principle.

THE CLOSE RELATION between workers' incomes and business activity is recognized by all. Every day it becomes more apparent that recovery depends upon the provision of jobs and earning power for those now unemployed. Thirteen million men want work. There is no substitute.

Employment Is Essential for Business Recovery

William Green

President, American Federation of Labor
Washington, D. C.

MORE THAN thirteen millions of our citizens have no work. No work means no income. About one-third of our families are living on savings or charity. There are millions of farmers who cannot sell their products for enough to pay their taxes. Our national income has dropped from 85 to 37.5 billions of dollars. With more than 50 per cent drop in purchasing power the opportunity for business to sell its products or services disappears proportionately and its earning power declines in the same degree.

With so large a portion of our population barred from employment, there is constant danger of revolutionary marching movements or revolts. Society requires us to pay for the necessaries of life. Those without income cannot pay. To the desperation caused by unemployment has been added very deep-rooted resentment against the irresponsible dishonest policies of bankers who contributed to our banking crisis.

Business without buyers and banks that must keep liquid block the way to normal recovery. Business will not seek credit to expand production unless it sees a chance to sell its products, and banks will not make commercial loans when depositors are likely to clamor for their money, and there is little or no chance for the individual enterprisor to better himself except as a part of a coordinated movement. What is needed is to start the wheels of production so that workers may earn their livings and purchasing power may be rebuilt.

The interests of the individual bankers run counter to the monetary interests of the country. Only the federal government can furnish the huge credit needed to start toward normal production, and only the federal government is responsible for underwriting

Behind each of these construction workers there is a chain of industrial workers producing and transporting construction materials.

national recovery. It devolves upon the federal government to initiate work programs that will enable us to earn our way out of this debacle. Legislation authorizing large expenditures for public works is our way forward.

Only in war time does the government normally have the courage to make large use of national credit. But defending our country against an armed foe is no more imperative than defense against the invisible but deadly forces of depression. For months we have been watching the contraction of our wealth-creating processes and the shrinking of values representing wealth. The swing downward of depreciation has been cumulative, with ramifications extending to a constantly widening area.

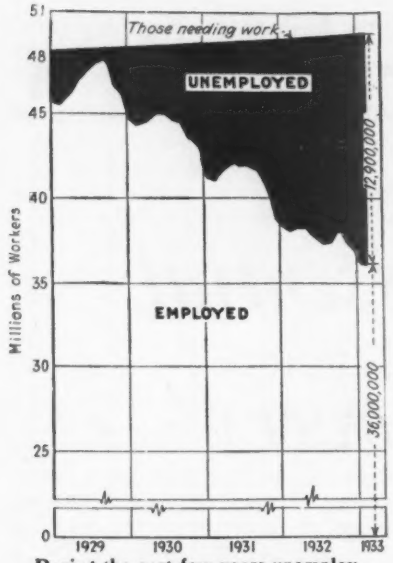
The shock of the stock market crash brought unemployment and business stagnation to limited groups, but as the downward movement grew the declining buying power affected additional industries. When the number of unemployed was in the neighborhood of 2,000,000, the reduction in wage payments equalled the decline in national income; but as the number of unemployed increased to 6,000,000, the decline in national income was approximately double the workers' loss in wages; at present the decline is about four times what industries save by laying off workers.

We are face to face with a dangerous situation. Men and women barred from normal living will not remain patient indefinitely. *These thirteen millions want work. There is no substitute.*

Providing income-earning jobs is an essential provision that must be a component element in every recovery plan. Merely settling our financial problems is not sufficient. The wheels of industry must turn, money must get into circulation with sufficient velocity to provide incomes for all. There must be central planning with central initiative. The federal government has the responsibility.

Two procedures are open: to initiate public works or to underwrite private industry. In deciding between these two methods we note that the producer industries which public works would draw upon are much more depressed than the consumer industries.

Between April, 1930, and January, 1933, the employees of these industries dropped from 6,247,000 to 2,892,000, or 54 per cent; wages dropped from $9,488,292,000 to $2,628,000,000, or 72 per



During the past few years unemployment has steadily increased until the present total is near thirteen millions.

cent. However, during the same period the wage earners in the consumer industries dropped from 3,792,000 to 2,960,000, or but 22 per cent, while their wages dropped from $4,394,910,000 to $2,423,898,000, or 45 per cent. Obviously by tackling the problem of getting the producer industries going we would start the industries that are normally the biggest employers with the heaviest payrolls.

Back of every worker on the spot of construction would be a line of workers getting out the materials and transporting them for use. Workers for these jobs would be pulled off the relief lists and their wages would be spent largely for consumer goods.

In addition to its own projects, our recovery program should include such semi-public undertakings as slum reclamation, homes for small-income groups, and sound construction projects. By stipulating that government funds should be used only for wages and materials for additional projects, the maximum effectiveness could be got from our public funds.

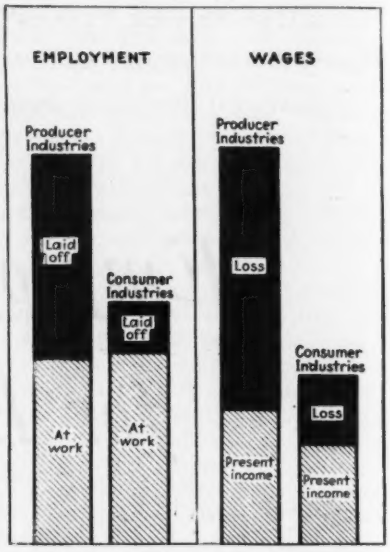
It is sometimes argued that construction undertakings put comparatively few persons to work, but these opponents rarely look back of the place of operation to the chain of activities set up by work on the job. Taking $1,200 as the average wage-earner's income and allowing $400 for materials per employee, Colonel Rorty takes $1,600 as the new capital expenditure per added employee-year. Estimating that one-half of each wage-earner's income is spent for non-agricultural production, this adds an additional half worker who in turn would spend part of his income for things needed, employing another one-quarter worker. Farm employment would also gain by increased demand for food. Taking the ratio between the decline of capital expenditures and unemployment, which Colonel Rorty believes is 3 to 1, the cost to the government of putting workers back to work is $533 per employee. This estimate checks closely with the estimate of Dr. J. M. Keynes, who estimates the cost at £133 but uses £150 to allow for price changes. If the more conservative estimate of 1 to 2 as the ratio between decline of capital expenditure and unemployment is used, Colonel Rorty places the cost per added employee on construction at $800—the upper limit.

A few billion dollars for construction projects would be an investment in jobs for recovery that would be only a fractional part of the loss in national income that continuing depression would take.

Unemployment in the construction trades is appalling and began in advance of the heavy decline in other industries. For the year 1930 the average unemployment in the building trades was 40 per cent; for 1931, 52 per cent; for 1932, 64 per cent. The savings and investments of these workers are practically exhausted. Jobs for them would put wages into hands that would immediately put them into circulation in the retail stores, in payment of bills, insurance, installments on homes, etc. This larger group of workers with comparatively high standards of living would begin a return to normal modes of living. The construction industry stands well at the bottom in business activity. Orders for construction would start the wheels of our heavy industries and would start a general even swing upward.

All decisions as to use of federal funds for economic recovery should be based upon the number of new jobs created as well as additional purchases of materials. The essential justification for using national wealth to promote business recovery is that it is the most immediate and practical way of giving the unemployed an opportunity to become self-supporting and thus increase purchasing power. The effect would be felt along the whole economic structure; engineers, chemists, laborers, brick masons, newspaper reporters, tailors, dentists, etc., all will benefit when workers are at work on the construction undertakings, supplying materials for the job, transporting, making the things for which the workers will spend their wages. As we noted earlier in this article, each man given a job on construction means two or three jobs in other industries.

If we do not scrupulously insist that federal funds be spent only to give employment and buy materials, an unduly large portion of money from the pockets of taxpayers will go into the pockets of investors and bankers. That is just the sort of thing that has so far come from the operations of the Reconstruction Finance Corporation. Important as it is to strengthen our financial and insurance institutions, it is even more important that the conditions upon which



The most drastic declines in employment and workers' income have been in the industries manufacturing producers' goods.

help is given should contribute to the end without which recovery is impossible—providing jobs for the unemployed. The decisive yardstick which the R.F.C. should apply to requests for credit is how many unemployed would get jobs.

The American Federation of Labor holds that in this emergency the 30-hour week should be made universal in order that the work hours available should be divided among the largest number of those needing jobs. If the 30-hour week were instituted, from a third to a half of the unemployed could find work at once, and the rest would be absorbed fairly quickly if weekly wages were maintained. In most cases the cost of additional workers with no decline in wage levels could be absorbed by a small increase in prices. As commodity prices are low, a small increase would be a negligible difficulty in business recovery.

The same provision—30-hour week—should be written into all government contracts for public works and governing all work done by subcontractors. If we have the courage and the will to provide work for the unemployed, we shall have to do the things that will make jobs available. This is the problem that must be attacked directly regardless of what we may do about banking, money, balancing the budget or saving economic institutions. If we attack boldly and on a large scale, we shall lessen the time needed for recovery.

A number of excellent practical plans have been proposed—such as the Rorty, the Kent and the Dickinson plans. We should not delay action longer but should initiate a plan of new capital expenditures to put the unemployed to work in order to restore purchasing power and to put values back into our investments.

THE SCOPE AND FUNCTION OF PUBLIC WORKS

FEDERAL CONSTRUCTION—*Harold L. Ickes*
PUBLIC WORKS OF THE STATE—*Edward Hyatt*
LOCAL COMMUNITY NEEDS—*Charles M. Reppert*

CURRENT EVENTS revolve about public works. What are they? To some they are post offices, to others they are harbors • Public works are structures of service facilities of many kinds, built by the joint effort of the community, to make industry fruitful and modern living tolerable • Our national government, the states, and city and county authorities must continuously minister to the needs of their citizens by constructing new improvements to serve them adequately • Three men of prominence provide accurate information on the scope and function of public works.

Public Works in the Federal Service

Harold L. Ickes
Secretary, U. S. Department of the Interior

THE FEDERAL GOVERNMENT as a builder contributes more to the well-being of the average citizen than he is likely to realize. Some of the government's activities must be directed to the development of the country as a national unit, others to increasing the working efficiency of business and industry, and still others to making the United States more livable for its growing population. Perhaps nowhere in the entire range of the national government's relation to its constituency is the breadth of its service functions so well revealed as in its construction activities.

Many of these activities center in the Department of the Interior, but the magnitude of federal operations cannot be appreciated without a look at the entire picture of federal construction. These activities are distributed through many departments and bureaus and are so numerous that a mere calling of the roll would become voluminous.

Vast scope of federal works

Most notable for their size and importance are the government's operations in developing rivers and harbors and its great public-road network. These, in the typical year of 1930, involved expenditures of $45,661,000 and $80,638,000, respectively, and touched every part of the country with their construction as well as their service influence. Improvement of communication through the building of national roads, the construction of canals, and the opening of harbors and river channels, it will be remembered, was among the first duties assumed by the government upon its formation. Flood control has become associated with these duties within the last half-dozen years; although not previously recognized as a necessary function of the federal government, it was seen in a new light after the 1927 Mississippi River flood. So also the associated service of making the power of streams and waterfalls available for public benefit has taken a place in the federal construction program of recent years. The Reclamation Service in the Department of the Interior took the lead in this, to be followed later by the stupendous wartime project of Muscle Shoals. As in all construction of federal public-service facilities, these undertakings were initiated by the direct demand of the people themselves. It will be for the people to declare their lasting policy in these new fields.

Construction of buildings is one of the necessary parts of government operation, as everyone knows. But few probably are conscious of the many-sided utilitarian requirements in this field and the wide diversity of kinds of buildings necessitated thereby. Government building construction includes such commonplace structures as stock barns for the Department of Agriculture as well as the Federal court buildings, customs houses, post offices and arsenals. Hospitals, schools and observatories are required if the imperative needs of citizen service are to be met.

Many operating facilities must be constructed by the government, such as the lighthouses that protect navigation and the lighted airways through which modern high-speed transportation is made possible. The protective requirements of the naval and military services, with their extensive army posts, navy yards and docks may be grouped with these. Allied to the latter again are such works as the helium production plant of the Bureau of Mines.

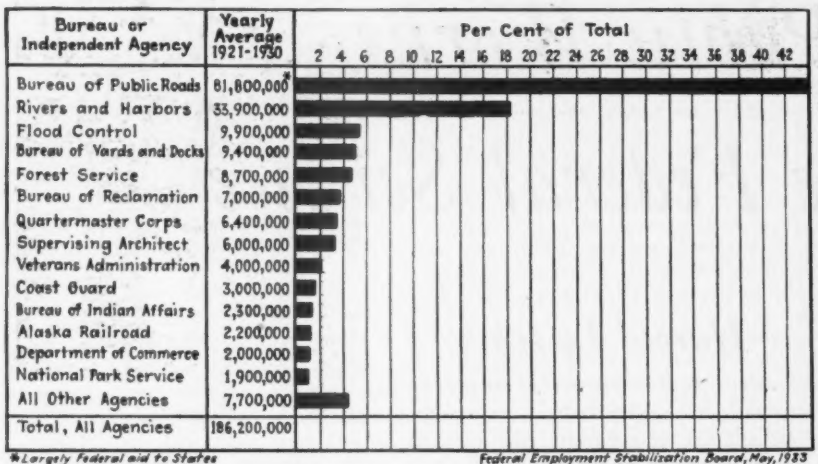
In all these fields the service nature of federal works of construction and the continuing need for improvements are clearly apparent. Even more is this true of the construction of developmental facilities. Here we have not only the

numerous necessary structures of the Department of Agriculture through which a better food supply is assured, but also the laboratories of the Public Health Service and the Bureau of Standards, among many others.

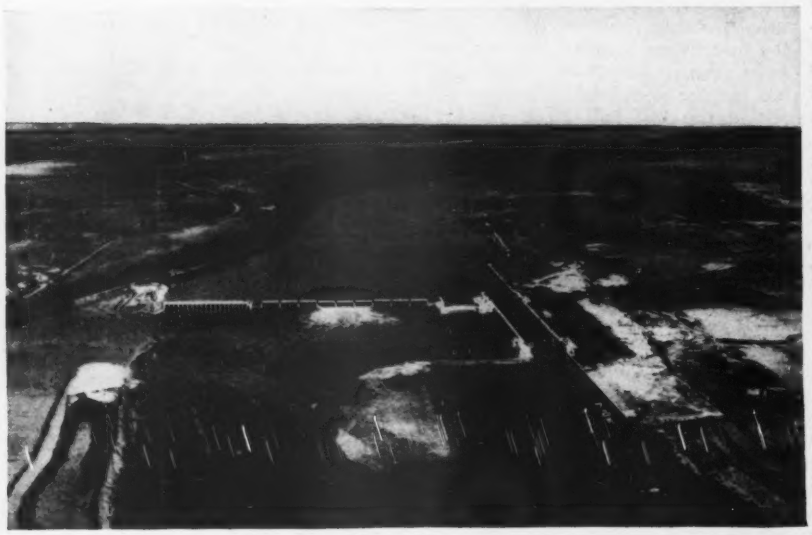
This federal construction is everywhere directly utilitarian in its nature, being planned to provide for public needs, both national and local. This may be a new concept to many citizens who, by reason of their residence or occupation, think of public works in terms of one specific type of construction. To the people in the Mississippi Valley it means flood control with its extensive chain of levees and spillways. To the port cities it means harbor improvements, and to vast inland areas it may mean good roads. To the lumberman it means tree culture and fire protection in the great national forests.

The accompanying diagram illustrates the relative rank of federal expenditures for construction. It reveals that the national government's contribution to the construction of the network of state highways is the largest item of public-works expenditure, representing 44 per cent of the total. Public buildings represent, on the other hand, only slightly more than 3 per cent of the total, although they are the type that is most in evidence.

The variety, utilitarian character and the nature of the continuing service of federal public works are typified by those built and maintained by the Department of the Interior. Taking first rank among the construction work of that department are those projects undertaken and executed by the Reclamation Service. During the 28 years of the operation of that bureau it has brought under cultivation 1,500,000 acres of idle land and has conserved the flow of a score of wild rivers whose floodwaters, flowing through thirsty deserts, otherwise would have run to waste. The Bureau of Reclamation now has nineteen projects where construction work is in progress, or where the projects either in whole or in part are being operated by the government. Outstanding among these is that developed through the construction of Roosevelt Dam, in Arizona.


Bureau or Independent Agency
Yearly Average 1921-1930
Per Cent of Total
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42
Bureau of Public Roads 81,800,000*
Rivers and Harbors 33,900,000
Flood Control 9,900,000
Bureau of Yards and Docks 9,400,000
Forest Service 8,700,000
Bureau of Reclamation 7,000,000
Quartermaster Corps 6,400,000
Supervising Architect 6,000,000
Veterans Administration 4,000,000
Coast Guard 3,000,000
Bureau of Indian Affairs 2,300,000
Alaska Railroad 2,200,000
Department of Commerce 2,000,000
National Park Service 1,900,000
All Other Agencies 7,700,000
Total, All Agencies 186,200,000
*Largely Federal aid to States
Federal Employment Stabilization Board, May, 1933

Federal expenditures for construction, by bureaus and independent agencies, excluding repairs and District of Columbia work.



Dresden Island lock and dam for flood control and navigation on the Illinois Waterway, a vital link in the Lakes-to-Gulf water route.

Irrigation work

When the government took over the reclamation of Salt River Valley, supplied by waters impounded by this dam, the few private enterprises in the area were bankrupt and the pioneer settlers were being slowly starved out. Without government aid that section of Arizona would have reverted to the desert. The government spent about $13,000,000, made its first spectacular demonstration of the possibilities that lie in storing water in the desert country, and thereby created farms from which the annual return from sale of crops is about $25,000,000.

In the Yakima Valley in Washington, when the Northern Pacific extended its lines into that section, there were no towns or farms, and the Yakima River ran unused to the sea. The government has now spent about $25,000,000 on the Yakima project, building reservoirs and canals, and construction expenditures are still continuing since the work is not complete. Instead of a desert, there are now thousands of acres of orchards, yielding apples of such superior quality that they are shipped to practically every country in the world. The irrigation of this valley has created Yakima, Ellensburg and several other smaller cities.

Another miracle was wrought in the North Platte Valley of Wyoming and Nebraska when the government started reclamation activities with the construction in 1905 of the Pathfinder Dam.

Since construction of irrigation projects was begun 28 years ago, the Bureau of Reclamation has built 65 storage dams and 53 diversion dams, the storage dams forming reservoirs with a combined area of 330,000 acres and a capacity of 14,000,000 acre-ft. Among the prominent structures are the 520-ft. Owyhee Dam in eastern Oregon, the 349-ft. Arrowrock Dam in Idaho, the 306-ft. Elephant Butte Dam in New Mexico, the 328-ft. Shoshone Dam in Wyoming and the 284-ft. Roosevelt Dam in Arizona. Under construction at the present time in the Black Canyon of the Colorado River is Boulder Dam, 730 ft. high and containing 4,400,000 cu.yd. of concrete in the main structure and appurtenant works, requiring 5,500,000 bbl. of cement. So great is this quantity of concrete that it comes near equaling that used by the bureau in all its former projects combined. The reservoir behind the dam will be 115 miles long and contain 30,500,000 acre-ft. of water. In addition to irrigation, the purposes of this dam are flood control, river regulation, domestic water supply, silt control and power development.

Among other construction accom-

plishments up to June 30, 1932, were the following: 13,680 miles of canals; 142 tunnels with a combined length of 46 miles; placing of 23,200,000 cu.yd. of masonry, earth and rockfill in dams; 260 miles of dikes and levees; 168,000 canal structures; 12,380 bridges, 16,120 culverts and 5,600 flumes; 1,480 miles of roads, 120 miles of railroad, 4,040 miles of telephone lines and 3,310 miles of power-transmission lines; 312,000,000 cu.yd. of earth excavation; placing 2,600,000 cu.yd. of riprap, 2,000,000 sq.yd. of paving and 5,100,000 cu.yd. of concrete, requiring 6,000,000 bbl. of cement.

Twenty hydro-electric power plants are in operation on 11 of the 30 federal reclamation projects. These plants have a total installed generator capacity of 102,550 kw., and during the fiscal year 1931-32 generated 331,739,500 kw.-hr. of energy, of which 21 per cent was utilized for irrigation and drainage pumping, 65.4 per cent was sold for commercial and industrial uses, and 13.6 per cent was used for miscellaneous purposes or lost. Eleven of these plants were operated directly by the government, and nine by the water users.

In the early days of federal irrigation, little thought was given to the utilization of hydro-electric power except as an aid in lowering the cost of construction. Typical cases of such early power developments are the Roosevelt power plant on the Salt River project, built to provide power for construction of the Roosevelt Dam; the Spanish Fork power plant of the Strawberry Valley project, in Utah, to provide power for the construction of the Strawberry tunnel; and the Lingle power plant on the North Platte project in Nebraska, to provide power for construction of canals. Cheap power is a requisite for irrigation pumping, and several of the larger hydro-electric power plants were built primarily for pumping purposes.

After the completion of construction, there was naturally a trend toward a power-consciousness on the part of the new settlers, who found power lines stretching along the canal banks, inviting use as the main lines of a distribution system reaching to individual farms. They discovered that this incidentally-developed power could be sold. The water users of the Salt River project, in Arizona, have utilized the entire head between the Roosevelt Dam and the project lands by constructing three storage dams with additional power plants. Income from power plants built as adjuncts to irrigation development, it has been found, can be made to bear much, sometimes all, of the cost of construction and maintenance.

Bonnet Carré spillway, 7,000 ft. long, designed to reduce flood heights at New Orleans by diverting a large portion of Mississippi River flood waters into Lake Pontchartrain.

Although the largest share of federal road money is spent by the states, considerable highway work is done by government bureaus in national parks and reservations.

Pedestrian and pack-animal suspension bridge built across the Grand Canyon of the Colorado River by the National Park Service.

Congress in 1930 made its initial appropriation for construction of the $165,000,000 Boulder Canyon project, greatest engineering project of them all, which includes a dam and power plant in Black Canyon of the Colorado River, and the All-American Canal. This project is now under construction by the Bureau of Reclamation. With a maximum head of 590 ft. available, it is planned to build a power plant with an installed capacity of 1,835,000 hp., with 4,330,000,000 kw.-hr. of electrical energy available annually, a capacity, incidentally, that is seven times the present capacity and three times the ultimate capacity of the Muscle Shoals plant on the Tennessee River. Income from the sale of this power will pay all expenses of operation and maintenance and the cost of construction of the dam and power plant, with interest at 4 per cent, within a 50-year period.

The All-American Canal will cost $38,500,000, to be repaid to the government by the water users. It will carry water from the Colorado River above Yuma, Ariz., to the Imperial and Coachella valleys in southeastern California. The main canal will be 80 miles in length, and the Coachella branch 130 miles, the main canal being the largest irrigation canal in this country.

Projects similar to Boulder Canyon on the Colorado River where revenues from power development can be utilized to pay a goodly portion of irrigation and flood-control costs exist in other river basins, namely, the Columbia River in Washington, the Snake in Idaho, the North Platte and Arkansas rivers in Colorado, Wyoming and Nebraska, the Sacramento and San Joaquin rivers in the central valleys of California, and the Rio Grande in New Mexico and Texas.

Work in the national parks

Another of the bureaus of the Department of the Interior that presents many and varied construction problems is the National Park Service. Its projects are scattered from Maine to Hawaii, and from Alaska to the Mexican border. They vary in type from the simplest of sanitation projects

Boulder Dam, showing foundation construction operations in the dewatered bed of the Colorado River

to the provision of all public facilities at one point for a sudden outpouring of 30,000 people. They graduate in magnitude and cost from that of a simple fire trail to a high-standard, high-speed automobile road. Listed among the park engineering works are to be found water-supply systems, electric-power plants, pumps to lift water as high as 900 ft., sewage plants, buildings, well-drilling, passenger elevators, drainage, flood and erosion control.

The big problem in construction work in the national parks is provided by the law establishing the National Park Service. Under its provisions the service is directed to preserve the national parks in their primitive conditions, yet to make them accessible for the enjoyment of visitors. To meet these two somewhat contradictory requirements equally is no simple task. Take the matter of roads, for instance. Ordinarily a good road follows the shortest distance between two points, compatible with the need for easy grades. In the national parks, roads are somewhat different. Planned as a means of access to places of special scenic interest in the parks for those traveling by automobile, the principal thought in their location, after considering grade and safety, is to enable the motorist to derive the greatest possible enjoyment from the scenery en route. To insure the best possible road standards, the Department of the Interior has a cooperative arrangement with the Department of Agriculture whereby the Bureau of Public Roads of the latter department handles all major road construction in the parks.

Bridges along the highways are built of native materials and are carefully planned from the standpoint of the landscape. One of the most interesting bridges in the parks is that over which the trail crosses the Colorado River at the bottom of the Grand Canyon. It is shown in one of the accompanying illustrations.

Obtaining an adequate supply of potable water often presents a problem. In Mesa Verde National Park, where naturally it is either very dry or very wet, with the dryness prevailing most of the summer season, great areas have been covered with sheet metal, and rainwater thus caught and carried to permanent reinforced-concrete reservoirs. Even this supply is inadequate, and at present a deep well is being drilled which has reached a depth of about 4,000 ft. At both Yosemite and Mount Rainier National Parks electrically driven pumps lift the water as much as 900 ft.

Construction in the Indian Service

The average citizen does not know very much about the government construction work that goes on in the Indian Service. It includes, for example, the construction and operation of irrigation projects, the development of domestic and stock water, the building of schools, hospitals and agency buildings, the installation of sewage-disposal plants at agencies and schools and the building of roads and bridges on Indian reservations. In deciding upon the economic feasibility of an Indian irrigation project, an element entirely foreign to the study of such a project for the white man must be considered. This is the question of Indian welfare, and quite often an Indian project, after taking this matter into consideration, is found to be feasible even though the actual per-acre cost may be so high as to make the same project infeasible from a strictly commercial standpoint. The major irrigation projects include the Fort Hall project of 60,200 acres in southeastern Idaho involving two reservoirs aggregating 453,000 acre-ft.; the Uintah project of 77,200 acres in northeastern Utah involving 24 diversion structures and 800 miles of canals and laterals; the Wapato project of 140,000 acres on the Yakima reservation in south-central Washington involving two diversion structures and 750 miles of canals and laterals, and two pumping plants; the Blackfeet project of 80,500 acres in northwestern Montana; the Flathead project of 124,500 acres in northwestern Montana in which are included eleven reservoirs and a 1,820-kw. hydro plant; the Crow project of 63,400 acres in south-central Montana; the Wind River project of 78,600 acres in central Wyoming; and the San Carlos project of 100,000 acres in central Arizona. The rest of the area of Indian irrigation projects is contained in some 90 different projects of various sizes.

The San Carlos project in Arizona contains 100,000 acres, of which approximately one-half is in private ownership and one-half allotted lands of the Gila River reservation. This project was initiated in accordance with the act of June 7, 1924, and the works consist of the Coolidge Dam across the Gila river near San Carlos, which creates a storage reservoir of 1,200,000 acre-ft.; a diversion dam across the Gila near Florence and approximately 700 miles of canals and laterals. At the Coolidge Dam there is a hydro-electric power plant of 12,500-kva. capacity.

Power is generated only as a byproduct of the use of water for irrigation.

Other work involves new buildings, power plants, heating plants, etc., together with the remodeling of existing buildings and work in connection with adequate fire protection, water supply and sewage disposal at the 110 schools, agencies and sanatoriums operated by the service. The roads and bridge-building activity consist principally of constructing secondary roads on various reservations, particularly in the forested areas.

These are examples of some of the tasks in only one of the federal departments, but they illustrate the unusual nature of governmental construction.

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Public Works and the State

Edward Hyatt

State Engineer of California, Sacramento, Calif.

SECOND of the American commonwealths, California has a typically broad range of state works. Its road and water problems are noteworthy. Mr. Hyatt outlines a scope of operations not unlike that of the federal construction described by Secretary Ickes. The irrigation districts, which are state agencies, also receive merited attention.

DURING normal times the annual expenditure on public works by the 48 states is 2½ billion dollars. Each state, in varying degree, has been and is actively engaged in a variety of construction enterprises, diversified in function and extensive in scope, to meet the needs of its people. The question may well be asked, "Why should the state engage in the construction of public works?" The answer naturally enough is that there are certain activities which, because of their inherent nature and their common interest and necessity to the people, can be successfully executed and directed only by the state. Almost without exception the needs that are served by these public works go beyond the boundaries of any particular subdivision of the state.

Public-works construction, because of the diversity of the state's functions, also is diversified in its nature. It ranges in type and size from a cell block in a penal institution to a highway development covering thousands of miles. While a number of activities are peculiar only to individual states, the great majority are common to all of the states of the nation. In general the more important activities typical of state undertakings may be grouped under five heads:

(1) Building facilities: Providing housing for educational purposes for administrative, legislative, regulative and judicial departments, for benevolent institutions, for correctional and penal institutions and for defense and police departments.

(2) Transportation facilities: Providing cheaper, safer and more expeditious modes of transportation for the business, commercial and recreational activities of the state.

(3) River and harbor improvements: Providing improved water transportation and shipping facilities for the promotion and benefit of intra-state, interstate and foreign commerce.

(4) Works for conservation, development, control and utilization of natural resources: Providing for the development and conservation of water, power, mineral, forest and agricultural resources.

(5) Recreational facilities: Providing parks, fish and game preserves, beach and other facilities.

The fundamental significance of state public works and the service rendered by them is well exemplified by the foregoing. In order to make the idea of state public works more tangible and specific, California practice can be taken as typical, and the geographical location, topography and natural resources of this state give it perhaps as wide a variety in types of enterprises as any other state in the nation. Some of these are carried out by the state itself, some by the state in cooperation with the federal government or with some political subdivision, and some by agencies created by the state, such as irrigation, water supply and general public improvement districts. Proposed expenditures by the state for the 1933-35 biennium are summarized in Table I, p. 619.

State office building in Los Angeles built to house the departmental headquarters in southern California.

Public buildings

Construction of buildings is necessary for housing departments of the government and for public institutions such as homes for the blind, aged, orphans and veterans, correctional institutions for the younger people, hospitals for the mentally deficient and penal institutions. California's total investment in public buildings and equipment up to June 30, 1932, amounted to $75,000,000, of which $14,000,000 is outstanding in 4 to 4½ per cent bonds. Building construction is under the supervision of the Department of Public Works, although the individual operations are carried out by various departments.

An activity allied to public building work has been the provision of the sum of $50,000,000 in state bonds to finance the purchase of homes and farms for the war veterans of the state. With outstanding purchases and contracts aggregating $47,564,000, there have been provided 396 farms and 11,304 homes. Nearly $5,000,000 of the bonds issued will have been redeemed at the end of the present fiscal year. This self-supporting activity is administered by the veterans welfare board of five members appointed by the governor.

Highways

Probably the most important and extensive program of public-works construction, measured in dollars expended, is the state highway system, which now comprises a network of 7,350 miles and will be increased by 6,600 miles if proposals before the present legislature are adopted. Fundamentally, the purpose of constructing highways is to provide, for the general public, a more economical, efficient and expeditious transportation service. Economic studies show that the highways in California have more than paid for themselves by the savings effected in cost of transportation.

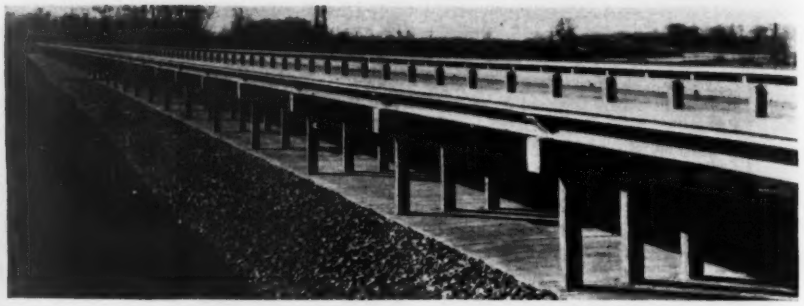
Highway construction, which accounts for the largest part of state public-works expenditures, often includes spectacular bridge building such as is pictured here.

The modern system of state highways in California was financed initially by bond issues totaling $73,000,000, bearing interest ranging from 4 on the first issue in 1909 to 5¼ per cent in 1921. In 1923, legislation was passed which provided for a two-cent gasoline tax to be used for construction and maintenance of state highways, and in 1927 an additional one-cent tax was added. One cent of this three-cent tax is expended by the state on new construction, one cent for maintenance and reconstruction, and one cent is turned over to the counties to be used for highway work. The total expenditures on state highways since the inception of the highway commission with the bond issue of 1909 to June 30, 1932, aggregate $288,000,000. In addition to this amount, $138,000,000 was apportioned to the counties from the gasoline tax and motor-vehicle fees from 1914 to June 30, 1932.

River and harbor improvements

The activity of the state in harbor improvement work has been confined primarily to San Francisco harbor, where extensive dock facilities and appurtenant works have been built at a cost of $33,800,000, financed partly by state bonds totaling $17,903,000 and partly by income.

A board of harbor commissioners composed of three members, who are appointed by the governor, is charged with furnishing, operating and maintaining proper facilities for handling commerce of the port. An important part of these facilities is the State Belt Railroad. The present value of the property is estimated at $100,000,000, created at no cost whatever to the state.



Flood-relief weir on the Sacramento River project, built by the state to protect rich agricultural areas.

Parks

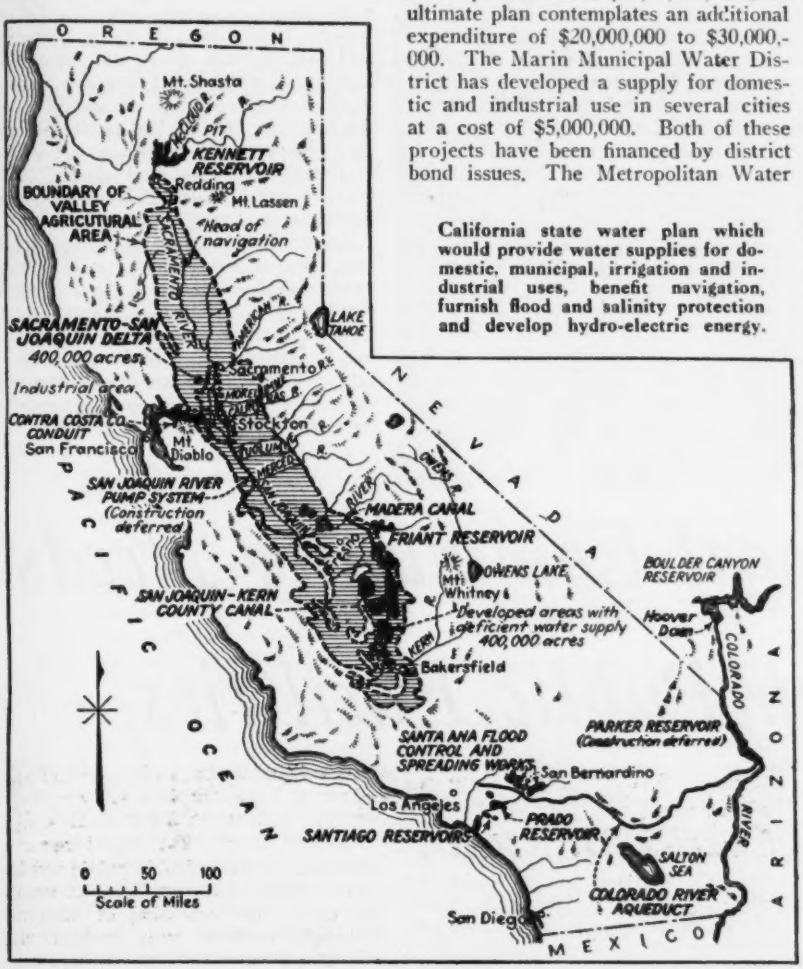
The state has under its supervision 56 parks covering an area of 289,000 acres and including sea coast, forests, lakes, rivers, mountains and deserts. They have been acquired through gifts or by purchase either by the state alone or cooperatively with public-spirited associations and individuals. Bonds in the amount of $6,000,000 have been authorized by the people of the state for the acquisition of these park areas, and about an equal amount has been contributed from private sources.

Forestry

The work of the forestry division of the state comprises the building of fire breaks, trails and roads and of reforestation outside the boundaries of the national forests and parks. The work in this division is administered by the state forester under the supervision of a board of forestry of seven members appointed by the governor. During the next biennium, it is proposed to expend $462,500 in state forestry work, which is financed partly from the general fund of the state and partly from special funds. During the past year, unemployment relief camps have been maintained under the direction of the state forester, involving an expenditure of $700,000, of which $280,000 was ob-

Storage dams such as the Pine Canyon Dam on the San Gabriel River are an essential part of state and district water conservation and flood-control projects in California.

tained from the Reconstruction Finance Corp. and the remainder from special state appropriations.



California state water plan which would provide water supplies for domestic, municipal, irrigation and industrial uses, benefit navigation, furnish flood and salinity protection and develop hydro-electric energy.

Many important public works are constructed by agencies that have been created by the state, such as irrigation, reclamation, municipal water supply, bridge and other improvement districts.

Irrigation districts of Califrnia have constructed works for the irrigation of more than 3,500,000 acres of land, or a greater area than is embraced in the projects constructed under the U. S. Bureau of Reclamation. These works, comprising dams, diversion structures, canals and power plants, have been financed chiefly by 4 to 6 per cent bond issues totaling more than $111,000,000. Present bonds outstanding aggregate $96,000,000, and more than $76,000,000 has been paid out in interest and amortization. The state engineer exercises supervision and partial control over the formation of each district, while a state securities commission certifies bond issues and supervises the financial affairs of the irrigation districts.

There are several municipal districts for public water supply in California. The East Bay Municipal Utility District, embracing seven cities on the easterly shore of San Francisco Bay, has expended about $40,00,000, and its ultimate plan contemplates an additional expenditure of $20,000,000 to $30,000,000. The Marin Municipal Water District has developed a supply for domestic and industrial use in several cities at a cost of $5,000,000. Both of these projects have been financed by district bond issues. The Metropolitan Water District of Southern California, a confederation of thirteen cities, including Los Angeles, has voted bonds in the amount of $220,000,000 to bring water from the Colorado River. Bonds in the amount of $42,000,000 have been sold to the Reconstruction Finance Corp. Contracts have been let on part of the aqueduct work, and construction is now under way.

The Los Angeles County Flood Control District is engaged in the development of a comprehensive plan of flood control and water conservation, involving the construction of reservoirs, channel control and other regulatory works. Bonds in the amount of $39,750,000 have been voted, and about $18,000,000 is yet to be expended for works now largely under way. Of the money spent for flood control in this district about $3,000,000 has been furnished by the state. Plans for future flood-control works involve an additional expenditure of $33,000,000 by the district.

Many reclamation districts have been organized in California for the purpose of flood protection and drainage. Over $100,000,000 has been spent to date by local interests for such works, chiefly in the Sacramento and San Joaquin valleys. In addition, about $23,000,000 has been contributed for flood protection by the federal and state governments.

In northern California, on San Francisco Bay, two major bridge projects are under way. One of these, the Golden Gate Bridge, across the entrance of San Francisco Bay, is being built by the Golden Gate Bridge and Highway District, comprising nine counties. Its estimated cost is $33,000,000, which will be financed by the sale of bonds secured by the revenues from the bridge and the property in the district. The San Francisco Bay Bridge extending from San Francisco to Oakland is being constructed by the state through the agency of the California Toll Bridge Authority, composed of five state officials. This structure, to cost $78,000,000, is being financed principally on revenue bonds issued by the Author-

TABLE I—PROPOSED PUBLIC WORKS EXPENDITURES 1933-35, STATE OF CALIFORNIA

Buildings	$1,679,000
Highways	53,336,000
Harbors	150,000
Flood Control	1,400,000
Forestry	463,000
Parks	400,000
Total	$57,428,000

TABLE II—PROJECTS UNDER CONSTRUCTION IN CALIFORNIA THAT ARE BEING FINANCED BY THE STATE OR STATE-CREATED AGENCIES

Project	Owner	Capital Cost
Colorado Aqueduct	Metropolitan Water District of Southern California	$220,000,000
Los Angeles County Flood Control Projects	Los Angeles County Flood Control District	18,000,000
Golden Gate Bridge	Golden Gate Bridge District	33,000,000
San Francisco Bay Bridge	State of California—California Toll Bridge Authority	78,000,000
Irrigation and Reclamation Districts		*1,000,000
Total		$350,000,000

*For the 1933-35 biennium only.

TABLE III—PROPOSED WORKS IN THE GREAT CENTRAL VALLEY PLAN

Item	Height of Dam (Ft.)	Capacity	Installed Capacity of Power Plant	Estimated Capital Cost
Kennett reservoir	420	2,940,000 ac. ft.	325,000 K.V.A.	$84,000,000
Sacramento-San Joaquin delta cross channel	...	10,000 sec. ft.	.....	4,000,000
Contra Costa County conduit	...	220 sec. ft.	.....	2,500,000
San Joaquin River pumping system	...	3,000 sec. ft.	.....	15,000,000
Friant reservoir	252	400,000 ac. ft.	30,000 K.V.A.	15,500,000
Madera canal	...	1,500 sec. ft.	.....	2,500,000
San Joaquin River-Kern County canal	...	3,000 sec. ft.	.....	27,400,000
Water rights and general expense	...	.....	.....	8,000,000
Total				$158,900,000

ity, which have been purchased by the Reconstruction Finance Corp, but partly from the gas-tax fund of the state.

In addition to other works proposed for construction by the state, as set forth in its budget (Table I), and in addition to the works of those public districts whose plans both physical and financial are well formulated and on which construction is about to start or is under way at the present time (Table II), there are several worthy and meritorious projects in California whose physical plans are well conceived and formulated but which require proper and adequate financing for their consummation. They range in magnitude from an expenditure of a few hundred thousand dollars to works costing many millions. Their aggregate cost is estimated at $280,000,000, made up of $30,000,000 for buildings, $10,000,000 for roads, $35,000,000 for water supply, $30,000,000 for flood control and $175,000,000 for the state water plan. Proposed developments are shown on the accompanying drawing.

The Great Central Valley plan is primarily to develop the water resources of the Sacramento and San Joaquin valleys, which contain over 8,000,000 acres of rich agricultural land susceptible of irrigation. There are now under irrigation in these two valleys 3,000,000 acres producing diversified crops and farm products with an annual value in 1929 of $300,000,000. The works proposed for immediate construction would involve ultimately an expenditure of $160,000,000 and would furnish adequate water supplies to two large producing agricultural areas (southern San Joaquin Valley and the delta of the San Joaquin and Sacramento Rivers) and an important industrial area (Suisun Bay region along the south shore of upper San Francisco Bay). In the southern San Joaquin valley 400,000 acres of rich alluvial land, developed and producing, are gradually being abandoned because of a lack of sufficient water. In the delta of the Sacramento and San Joaquin rivers salt water incursions during the low-water season have endangered the productivity of the irrigated lands. And in the Suisun Bay region encroachment of salt water is endangering industrial plants. The Great Central Valley Project is shown in the hatched area of the map.

California activities and projects have been chosen as typifying state public works because of the writer's greater familiarity with them. Every other state has similar work under way, pending or proposed. The intent of this article has been to show what comprise state public works and to indicate the necessary service that they render.

Serving Local Community Needs Through Public Facilities

Charles M. Reppert

Chief Engineer, Department of Public Works, Pittsburgh, Pa.

THE DEPENDENCE of all domestic and business life on publicly built facilities is most fully revealed in city affairs. Pittsburgh's work in overcoming topographical handicaps and developing beauty and efficiency is an example of what public construction accomplishes. Mr. Reppert's long service in Allegheny County and Pittsburgh lends authority to his statement.

IT IS DOUBTFUL if the average citizen realizes the extent and significance of the services and facilities furnished by his municipality. As a matter of fact, the public works of a municipality are so closely related to the needs and welfare not only of the general community but of each individual, that it is to the interest of all, in this time of economic appraisement and of revaluation of needs, to consider fully the benefits which accrue to the public through its public works.

The public works of a city, representing the investment of the community in facilities furnishing necessary services to the public, are absolutely indispensable for the physical, financial and social well-being of the community. They are made up in large part of physical plant and properties, which not only must be maintained in satisfactory physical condition but must be extended and expanded constantly in order to meet the developing needs and growth of the community. At the same time the accumulated investment in public works and facilities and the cost of their operation is such that replacement, construction and expansion are necessary also in the interest of satisfactory service and economical operation.

Public works of an extremely varied nature are required to meet the many vital needs of the local community. They include dock and terminal facilities, railroad crossing separations, traffic-control signals, sewage and refuse-disposal plants, works for the purification and distribution of water, and rapid transit. The development of parks and recreational facilities, to relieve the social problems that have been created by the congestion of urban populations, has furnished, in an increasing degree, opportunities for valuable public works.

As a result of the rapid expansion of our cities, the furnishing of adequate municipal services with modern and efficient public works has not kept pace with the demand. And further, in the last few years many pressing and necessary projects essential to the prosperity and growth of our cities, and possibly affecting health and safety, have been allowed to lapse. At the same time the effects of wear and tear and time have continued to depreciate all physical municipal property, such as waterworks, streets, bridge structures, sewers, etc., with consequent effects upon the convenience, welfare, health and safety of the public, not to speak of the loss of economy and even danger in operating obsolete equipment and plant.

The absolute necessity for the very existence of urban life and the welfare and prosperity of citizens is revealed only by a thorough consideration of the inter-relations between the public and their municipal works.

How does the citizen come into daily contact with them?

The volume of business of merchandising concerns both wholesale and retail is influenced by the adequacy of the street system. Many illustrations can be called to mind of districts in business centers that have been adversely affected

by traffic congestion and restriction of circulation. It is possible to remove these restrictions by improving the street system.

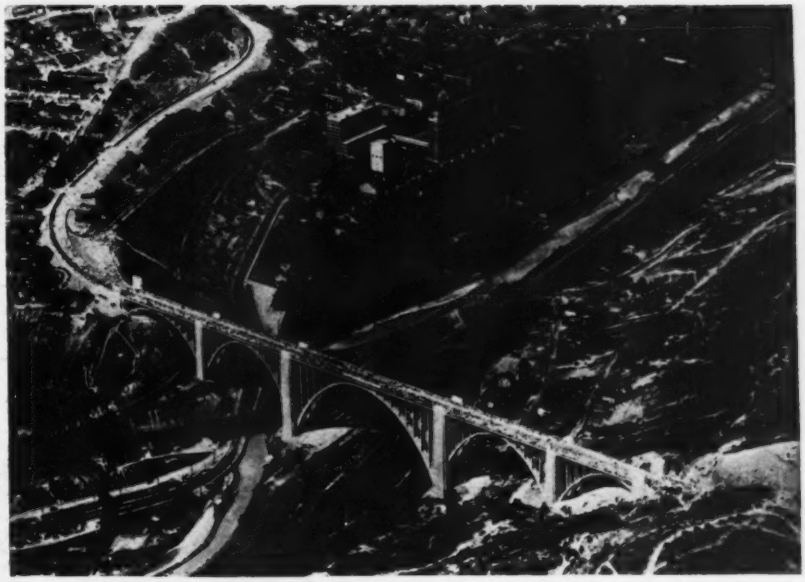
The safety of the public is one of the great moral obligations of a municipality. The value of this factor cannot be measured in dollars and cents, but lack of attention to this obligation has its very definite penalities. Water supply for fire protection is a matter of public safety; if bridge structures are not properly maintained to meet present-day conditions, catastrophes may result; the elimination of railroad grade-crossings and the separation of grades of important vehicular traffic intersections contribute further to the protection of the public.

Coordination of traffic facilities is another objective of city development of great and increasing value. Adequate street-system facilities are necessary in order to serve properly industrial and commercial activities in connection with the railroad terminals, harbor and river terminals and airports. The building up of the community's business in all lines requires the carrying out of projects of this character. It is frequently accomplished by joint participation with transportation companies.

The present and future value of real estate is largely dependent upon the maintenance and furnishing of adequate and satisfactory services through public works, and the maintenance of such values is a most important object of public service and facilities. It is evident that failure to furnish a satisfactory and ample water supply, to neglect to make suitable provision for sewerage and drainage, or to furnish inadequate street facilities will react to the detriment of real estate values. The effect upon real estate in providing and maintaining public works is a most important consideration, and further, while real estate bears the greater part of the burden of cost, yet it is the chief beneficiary. Public-works projects, the cost of which is spread over a long term of years will, if intrinsically sound, fully justify the present expenditures by the maintenance and often by the increase of real estate values.

The modern city, with so many fields of activity and serving so many public needs, has become increasingly complex. It cannot be too strongly emphasized that in the interests of both economy and effectiveness any plan of public-works improvement should be carried out in conformity with a well-balanced and comprehensive plan of city development. This includes not only conventional city planning but financial planning as well, due consideration of relative need and value, adjustment to financial resources and consideration of all the factors involved. If this is done, there will be no waste of public money in carrying out ill-advised projects, and on the other hand full value will be received.

The amount of public works construction performed by local communities has been drastically curtailed in the past few years. The trend is well illustrated by the accompanying chart showing the combined expenditures by the city of Pittsburgh and Allegheny County for the years 1924 to 1932, inclusive. During this period the city spent $27,400,000 and the county $60,500,000 on contracts for major public improvements, this being exclusive of damages which averaged about $10,000,000 per year.



Pittsburgh's rugged topography presents many difficulties to communication. The George Westinghouse Bridge crosses high above the Turtle Creek Valley, replacing a congested, hazardous street.

This investment in public works was a part of a program initiated by the county in 1924 and by the city in 1926, and one which was practically completed at the end of 1931. The joint program reached its peak in 1929 when construction work contracts amounted to almost $20,000,000. In 1932 the volume of construction activity had decreased to less than $2,000,000. This is convincing evidence of the almost total elimination of major public-works improvements.

The necessity of carrying out municipal public works and what is to be accomplished thereby is best illustrated by describing what has been and what is proposed to be done by a typical community. For this purpose the past and present program of major improvements of the Pittsburgh Metropolitan District will be described. This Metropolitan District has a total population of about 1,400,000, including the city of Pittsburgh, with a population of about 675,000, and numerous adjoining residential and industrial communities.

The topography is characterized by the river valleys of the Allegheny and Monongahela and Ohio rivers, which, together with numerous ravines and valleys, has a range of several hundred feet in elevation. The central business district located in the triangular peninsular area at the confluence of the rivers is by reason of topography and past development a natural focal point of traffic movement. In general, the district is characterized by comparatively low, level territory of varying width along the rivers, often extremely restricted with high and precipitous hills forming the river valleys.

Street system improvements

The street system of a city is the most prominent factor in its physical development, for it is the framework of the municipal plan. A city's present character has been largely determined by the effectiveness of its street system, and its future prosperity, growth and welfare will be greatly influenced by what is done, or not done, in providing adequate and convenient means of communication.

While it is the chief factor in making and preserving values of real estate, it is likewise the chief item of cost in city development. In addition to the cost of maintenance, the system must be extended and expanded in order to take care of the demands and needs of the community.

It is often found that more convenient connections between the street system of the city and the outlying road system would be desirable. From a financial and business standpoint, the development of street and road systems is of the utmost value, as its objective is the bringing of communities closer together, thus promoting commerce and business. But in many cases the improvements to a major street system that are found to be most needed are those that are most expensive to construct, for our street systems in the past have generally been developed along the lines of least resistance. To a considerable degree,

the replanning and remodeling of the existing street system by widening and relocating of streets is found to be necessary, and this entails damages for land and buildings. It also frequently involves expensive construction costs on account of topographical obstacles that have therefore prevented the carrying out of projects.

As a part of the improvement program of 1924 the street facilities of the central business district of Pittsburgh have been vastly improved and extended by the building of bridges, interior re-improvements and the opening up of new arterial street connections; boulevards have been constructed connecting up the central business district with outlying centers, and the system of state and county roads serving the metropolitan district and connecting with the state highway system has been improved and expanded.

Bridges and tunnels

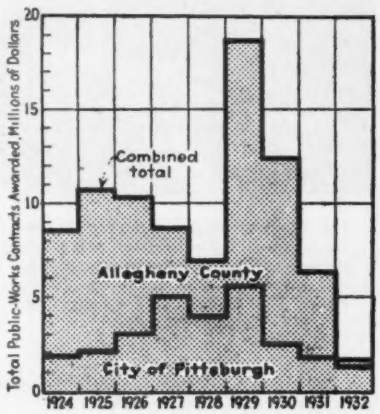
To furnish more convenient and direct street connections, to relieve the serious traffic congestion and to meet the demands of the rapidly expanding municipal growth, obsolete bridges with narrow roadways were replaced with modern structures, traffic tunnels were constructed, and a number of notable boulevards and main-thoroughfares projects were carried out.

Bridges are of paramount importance to Pittsburgh. The central business district of the city, limited in area to 200 acres, is confined by rising ground to the east and by the rivers, which form two sides of the triangular area occupied. On opposite sides of the rivers (the former city of Allegheny to the north and the South Side district to the south) lie secondary business and commercial centers whose activities are closely related to that of the central business district; together these areas form the business districts of the metropolitan center. Thus, the central area or "Point District" is accessible only by means of river bridges from the north and south, while the connections to the east are limited by topographical conditions. As a result of what has been accomplished to date, the circulation of traffic in the district has been much improved, and arterial thoroughfares and their connections with the district's street system have been greatly augmented to the advantage not only of the business district itself but that of the tributary residential and business districts.

In 1924 there were eight river bridges serving the central business district, three to the south and five to the north. Many of these bridges were obsolete and inadequate, and in questionable physical condition. An important phase of the improvement program, therefore, was the replacement of a number of bridge structures.

The old two-lane suspension bridge crossing the Monongahela River at the Point, upon which it had been necessary to restrict the loading, was replaced with a modern structure. The Sixth, Seventh and Ninth St. bridges over the Allegheny, two of which were in questionable physical condition, were also replaced with new bridges. The South Tenth St. Bridge, furnishing an important connection between the South Side and the easterly margin of the Point business district, was replaced and a cutoff vehicular tunnel was constructed.

The Liberty Tunnel and Bridge project, completed in 1927 at a cost of $10,000,000, besides furnishing a badly needed new traffic connection into the downtown business district, provided a new, more adequate and much shorter connection with extensive suburban areas. The tunnels consist of twin tubes, each carrying two one-way lines of traffic, with a total length of 5,500 ft. Before the improvement, access to these districts was possible only by tortuous routes over narrow streets on steep grades. As a result, the growth of the city to the south was seriously impeded. There has followed a phenomnal upbuilding in the territory served. As an illustration, real estate valuations in one township alone have increased $27,000,000 since the project was started.



In 1924 a comprehensive program of public improvements for the Pittsburgh region was inaugurated by Allegheny County. The city joined in the program in 1926. As indicated by the curve of expenditures shown above, the combined program reached its height in 1929.

To relieve traffic congestion on the cross-town streets of the business district, the city in 1927 widened Grant St. so as to provide for six lanes of traffic, this street extending across the city near the easterly margin of the business district. This improvement, involving the cutting back of buildings throughout the length of the project, was carried through at a cost of $1,700,000, and has not only served greatly to relieve traffic congestion but has rehabilitated real estate values to a considerable extent.

The installation of traffic signals of the flexible progressive type has also played a most important part in meeting Pittsburgh's traffic problem, by increasing the traffic capacity of the present street system. A rather complete installation costing $260,000 and providing for the installation of signals at 78 intersections, has been made in the central business district and is being operated with marked success. At the same time signals have been installed where required throughout the city, at a total expense of $550,000.

As a result of the improvements described, the movement of through and local traffic in and out of the central business district has been materially facilitated. At the same time, however, the improved facilities, the growth of the city and the normal increase in vehicular traffic have resulted in a marked increase in the number of vehicles entering and leaving the district. While much has been accomplished, additional improvements must be carried out to solve fully the traffic problem and to relieve depreciated properties and business concerns suffering from the lack of adequate street facilities.

A most important feature of the ultimate plan for the downtown district is the marginal thoroughfare which has just been recommended in the final report of a special committee appointed by the mayor as a part of the comprehensive scheme of riverfront development. The scheme, to cost about $4,500,000, contemplates the building of a viaduct along the wharf on the two riverfronts, which, in conjunction with the existing riverfront streets, will provide a free-flowing traffic route for bypassing through traffic and redistributing local traffic. The scheme also contemplates the improvement of the wharf itself to increase its usefulness and appearance. The project is being urged, not only as a definite step in traffic relief but in property rehabilitation as well.

Main thoroughfares

The character of the topography has rendered difficult the development of a satisfactory street and road system to connect up the various districts and areas with each other and with the business district and secondary centers. Old streets followed the rivers and interior water courses and valleys. In 1924 the street system was decidedly inadequate and, in addition, definitely restricted the continued growth of the city. The public-works program of 1924 included numerous major projects for the creation of new and improvement of old arterial thoroughfares. One of the principal objectives, now accomplished, was the projection and construction of high-speed traffic arteries to connect the outlying districts with the heart of the downtown business district. The value of these improvements to the community and to business is unquestionable.

The most important major street proj-

ect carried out by the city at a cost of $2,000,000 was the extension of the Boulevard of the Allies, which had been begun in 1921 and partly completed. This project was characterized by extensive viaduct construction and by a hazardous and difficult side-hill location. This major artery serves the routes of the Lincoln and the William Penn highways through the city.

Both these great highways pass through the downtown business section of Pittsburgh and extend eastward, traversing the Boulevard of the Allies and then proceeding eastward through the Borough of Wilkinsburg, thence via the Ardmore Boulevard across the Turtle Creek Valley. This important route formerly extended through the congested Turtle Creek industrial valley, traversing a very narrow street, and after crossing Turtle Creek it climbed up a very long and severe grade to the high ground beyond. The conditions greatly impeded the movement of traffic and made the operation difficult and at times hazardous. The Turtle Creek Cutoff and Westinghouse Bridge project were carried through by the county with the cooperation of the state. The road now crosses high above the crowded Turtle Creek Valley by the new George Westinghouse Memorial Bridge, which provides an adequate thoroughfare with good grades and eliminates the delays and interferences of the old route, reducing the time of travel very materially. It is a further step in bringing the outlying communities into closer contact with Pittsburgh.

There is now under consideration a further improvement on the line of the Boulevard of the Allies and the Lincoln Highway, which in effect will form a continuous high-speed cutoff route from the Ardmore Boulevard through adjoining municipalities into the city with few street crossings, and finally by a tunnel connecting with the Boulevard of the Allies. The time of travel will be reduced at least 45 min. for the important outlying industrial centers. When this project is ultimately completed, it will serve two very necessary purposes: that of providing a much shorter route between the city and numerous and populous communities, many of them manufacturing centers; and further it will relieve traffic now approaching saturation on existing thoroughfares.

The Ohio River Boulevard, developed by the county, provides a wide thoroughfare serving the many populous communities and that portion of Pittsburgh on the northerly side of the Ohio River. Previously both local and through traffic was compelled to use a single narrow main street having car tracks. The main project is 5½ miles in length, cost $6,360,000 and required the construction of twelve bridges.

Previous to the inauguration of the major street improvement program there were no bridges crossing the Ohio River below the Point for a distance of about 12 miles. As a consequence of this condition the development on both sides of the river suffered. The construction program, therefore, wisely included the construction of two new bridges over the river. The North Side-West End Bridge was built a short distance below the Point to join the traffic thoroughfares on the two sides of the river. This bridge was constructed at a cost of $3,500,000. A somewhat similar purpose has been achieved by the construction of the McKees Rocks Bridge, which extends from the new Ohio River Boulevard on the north to the Borough of McKees Rocks on the south. McKees Rocks is a closely built up and developed industrial community, while the districts on the north side of the river are attractive suburban residential areas. The bridge itself is of the arch type with suspended roadway, and is 5,510 ft. in length between ends of approaches. It cost $5,160,000.

The Ohio River Boulevard and McKees Rocks Bridge furnish a new arterial traffic route, connecting an industrial area with a residential section.

The program of major street and road improvements described, which has cost the city and the county $70,000,000 in the last ten years, has been expensive, but it has added materially to the wealth and welfare of a great metropolitan community. It has brought the various districts, previously to a great degree detached, closer together and has in a large measure furnished facilities indispensable to the welfare of the people.

Waterworks improvement projects

Waterworks systems perform an absolutely essential service. Their intimate relationship to the welfare and health and safety of the community are well recognized. The supply must be pure, adequate and dependable for domestic and industrial use and to insure fire protection. Higher insurance rates are the penalty for inadequacy.

Replacements and improvements must constantly be made to a waterworks system if efficiency and economy are to be preserved. Pittsburgh has since 1926 been engaged in just such a program, which has now been partly completed. The program has involved the expenditure of almost $5,500,000 and will require about $4,500,000 more to complete. It has been based on a carefully considered general plan and a thoroughgoing analysis of conditions and requirements. Pumping stations have been rebuilt and re-equipped, reservoirs repaired and additional ones built, the pipe-line system reinforced by replacements and additions, and losses have been reduced by waste surveys and systematic pipe-line and meter repairs.

It was realized in 1926 that the Pittsburgh water system was deficient in many vital respects. In three pumping stations the equipment was obsolete to the point of actual operating danger as well as wasteful operation. One major reservoir was so leaky that it was considered risky to fill it more than 60 per cent full, while two others suffered from the same limitation to a lesser degree. Steel storage tanks were approaching failure, and required immediate replacement and were inadequate in capacity. Certain sections of the city were supplied by only single mains in unsatisfactory condition, and this inadequacy coupled with limited storage had adversely affected insurance rates.

The old Brilliant Pumping Station, which had become entirely obsolete, has been completely replaced by a modern electric station. The Ross Station, formerly equipped with inefficient units in poor mechanical condition, was modernized as a steam station, and a

faulty intake system was supplemented by a new intake. The Howard St. secondary station in the North Side was also electrified, and obsolete equipment scrapped. The gross cost of these changes was $1,855,000.

The leaky Highland Reservoir was relined completely, as was also the smaller Bedford Reservoir, while improvements in the control system were made at a third reservoir. Three sets of steel tanks on the North Side were scrapped, and two much larger concrete units were constructed, increasing the storage capacity from four to forty hours. With some revisions in pipe lines one minor pumping station was eliminated.

Numerous reinforcements to the pipeline system have been made, including additional riser mains from stations to reservoirs, an additional under-river crossing between the main city and the South Side, and other lesser additions too numerous to mention here.

The economies gained are clearly and forcibly demonstrated by the fact that operating expenses of the Bureau of Water have been reduced from $1,401,000 in 1926 to $1,145,000 in 1933; at the same time the revenue from water rentals has increased from $2,860,000 to $3,089,000 in the past seven years, or a net gain in economy of $485,000. This is a very substantial return on the additional investment without considering the improvement to service.

There is every necessity for proceeding with the completion of the improvement program. Recently additional funds in the amount of $200,000 have been provided, and the completion of the program at an additional cost of $4,500,000 will be carried out as soon as funds can be made available.

The recent authorization includes the electrification of the Herron Hill Pumping Station at a cost of $127,000. The equipment of the station has become obsolete, and present operating and maintenance costs are excessive. The capacity of the station will be increased, and operating costs, after deducting fixed charges on the new investment, will be reduced about $15,000 per year.

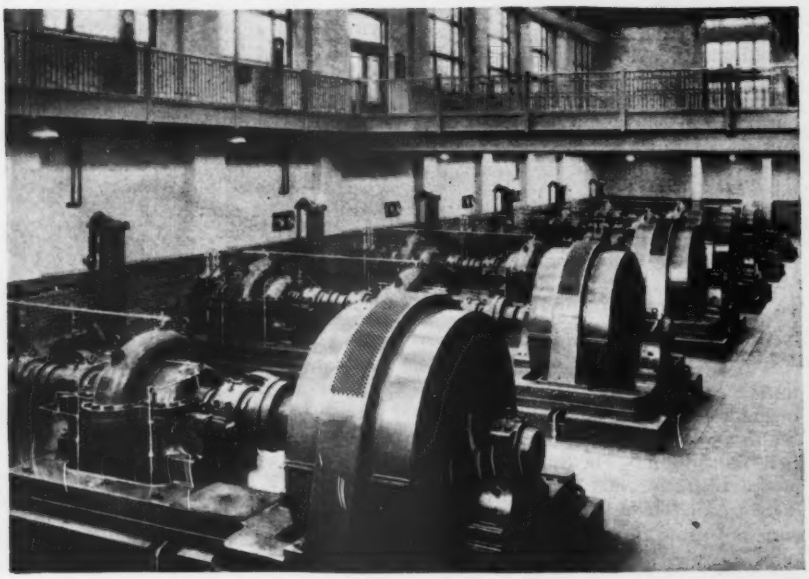
The current program also will provide a badly needed replacement and increase in capacity of the Allentown tanks serving as storage for the high-level territory south of the Monongahela River together with an additional pumping unit in the booster station serving the tanks.

The remaining projects, which should be carried out to put Pittsburgh's water-supply system in satisfactory shape and which, it is estimated, will cost about $4,500,000, would include the following important features:

The construction of the new reservoir east of the city together with the booster station and the necessary rising mains and distribution lines is proposed at an estimated cost of $1,250,000. This new plant extension is proposed in order to furnish service to a rapidly growing high-level territory known as the Squirrel Hill district, which is now supplied through an existing station that has reached the limit of economical development. To a great extent also there will be a reinforcement of supply for fire protection by supplementing the present supply, which depends entirely upon pumping by adequate reservoir storage.

It is also proposed to supplement the North Side supply by doubling the storage reservoir capacity at a cost of $220,000 and to expend approximately $2,700,000 on additional pipe lines in various parts of the city. The largest of these pipe-line projects, estimated to cost about $1,600,000, is the building of a duplicate rising main and supply main to serve the North Side district, which is now dependent upon a single pipe line that was beginning to show the effects of deterioration. As the service of an area of the city with a population of about 150,000 is affected, a reasonable margin of safety demands the additional investment.

A new waterworks pumping station replaced the old obsolete Brilliant steam-pumping station. The new equipment has produced important economies.



Sewerage and drainage projects

The sewerage and drainage systems and sewage-treatment plants must be constantly extended and enlarged to meet the demands of the expansion and building up of the city. Intensification of urban development inevitably results in increased discharge of stormwater and domestic sewage. The development of new territory requires the extension of old systems or the building of new ones. The foregoing conditions place upon the community the necessity of adding continuously to its investment in sewerage and drainage. If this is not done, insanitary conditions will ensue, damage to private and public property will result from backflooding and surface flooding, and the growth of the city will be prevented.

A greater part of Pittsburgh's sewerage system is on the combined plan (domestic sewage and stormwater carried in the same system) and includes about 700 miles of sewers of various sizes. Since 1926 the city has expended in the neighborhood of $2,700,000 on the construction of trunk sewers to remedy some very serious cases of inadequate sewerage and drainage facilities. The need now exists for further improvements, which are estimated to cost $3,000,000, the building of which would eliminate the danger of serious backflooding in a number of large districts.

While Pittsburgh discharges its sewage into the rivers, there are many cities where sewage-treatment works should be installed and where existing works should be enlarged. Where such cases exist, there is a very definite and valuable return to the public in the conservation of health and the elimination of offensive conditions.

Municipal airport

The municipal airport, constructed by Allegheny County with the aid and cooperation of Pittsburgh, is located about 8 miles from the downtown Pittsburgh district and has ample high-speed highway facilities. It is the most complete airport in the United States, all runways being paved to a width of 500 ft.

From this survey of the work done by a typical community in providing its citizens with public facilities, it becomes apparent that the building of modern cities has been made possible only by public works. The proper maintenance, replacement and expansion of such works is vital to their continued existence, welfare and development. The social and economical problem of urban communities can be solved in no other way.

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HAVE WE TOO MANY PUBLIC IMPROVEMENTS?

UNSATISFIED SERVICE NEEDS—*Malcolm Pirnie*
OUR PRESENT INVESTMENT—*Louis Brownlow*
PRODUCING AND SAVING—*Willard Chevalier*

"WHY BUILD more public works? They are already bankrupting us!" some say. The protest merits examination • As public facilities enter into the life of every person, it is an intensely practical question whether we are overbuilt • Examination of existing conditions by a widely informed engineer indicates that our public facilities are sadly deficient • A city management authority says that our public investment is moderate and is well amortized • For the security of our savings, public improvements are an essential reservoir of continuing investment.

Service Requirements Determine Public-Works Construction

Malcolm Pirnie
Mayor of Scarsdale, N. Y.; Consulting Engineer, New York City

CONSTRUCTION of public works as a means of making substantial capital expenditures is receiving international attention today. The joint statement by President Roosevelt and Prime Minister MacDonald, April 26, 1933, contained the following statement pertinent to this fact:

"Enterprise must be stimulated by creating conditions favorable to business recovery, and governments can contribute by the development of appropriate programs of capital expenditures."

Construction offers the primary field for capital expenditures. Resumption of construction of deferred public works offers the logical field, for here governments can develop immediately substantial capital expenditures and at the same time yield permanent increase in public health, wealth, safety opportunities and conveniences.

Two million men could be employed directly on the job and in the production and transportation of materials if only those public works of villages, cities, counties and states that have been deferred during the depression could be undertaken. At least four million more could find employment in furnishing these men and their families with the things they need and have been unable to buy during the last three years. There can be no doubt that the progressive spending accompanying such a substantial release of new purchasing power would stimulate business and promote trade recovery. It is extremely important to remember that in public-works construction no increase in capacity for production of commodities would be provided, so that existing plants would receive the entire benefit of increased demand for goods.

With such potential aid to revival of employment and business in a resumption of public-works construction, it is essential that citizens should recognize the real service value of public works and understand that they are vitally related to normal and necessary service of the community. Advancement in standards of health, safety, communications, education and business methods, in fact advancement in the entire standard of living, happiness and convenience of the public is absolutely dependent upon advancement in public-works construction.

Why then should people be taught that public works are luxuries? Why should past expensive methods of financing works built to raise the standard of living be held up as proof that they should not have been created? The facts are that we have only begun to build up our public services, that all those so far created were built after months or years of planning and discussion, and that we have built up what now appears to be a large debt for our hard-won public facilities simply because we did not adopt the best method of financing their construction. Our roads, schools, hospitals, waterworks, sewers, bridges, canals and harbors have not been thrust upon us; they are the physical answer to insistent expressions of public need.

Conflicts of interest in different types of public works naturally occur. A country district may be deeply interested in building a large modern school house at the intersection of two new hard-surface highways, to take the place of several small red frame buildings of yesterday. The people of such a district are likely to speak of harbor improvements as gross extravagance. Other people interested in building a hospital may be impatient about bridge costs. Freight shippers may denounce country road improvements and irrigation works while demanding large expenditures on navigable river improvements. However, in every case, the service of the whole community is involved. The conflicts of opinion arise solely from the fact that those close to the particular element of service in question know best its relation to the public good and know little about needs just as great for other public works.

We have been justly proud of our national standard of living, relatively high in the community nations. This has been made possible by public facilities which have been developed in step

with growth in science and private enterprise. Unless we are now to retrogress toward more primitive conditions, such construction activities must continue. Human progress cannot permanently be blocked, but an orderly advance is to be preferred to periods of stagnation followed by periods of feverish activity to make good deferred progress. Not so long as there is evolution in humanity will our public-works program be completed.

Many erroneous views of public-works construction have been given widespread publicity through the press in recent months by those who should have acquainted themselves with facts before making their statements. It is evident that they did not do so. Such publicity has had an adverse effect upon orderly progress in the creation of public facilities, and to offset the damage so done it is essential to know better the service value of public works. What are the facts?

Three functions are served

The present industrial and business society requires for its secure and progressive existence three community functions: protection, service and development. Each of these is dependent upon physical structures for adequacy and continuity. City halls, court houses, police and fire-protection facilities, military and naval equipment, water-purification plants, hospitals and numerous agencies for combating disease, and elimination of unsanitary conditions are all produced by extensive works of construction and must be operated and maintained by adequate, trained personnel for protection of life, health and property. In the field of service, contributing greatly to present living standards, are waterworks, sewerage, transportation ways by land, air and water, waste collection and disposal, streets and sidewalks, necessitating construction of pipe lines and pumping stations, river and harbor improvements, incinerators, highways, pavements, bridges, tunnels, and drainage and irrigation works. Finally, to realize social developmental values for ourselves and our children, we provide schools, colleges, libraries, monuments, experimental farms, research and statistical facilities, parks and playgrounds.

There is thus established a remarkably broad and ever-increasing range of demands for public facilities. But in no field is present service complete and adequate, for civilization advances too rapidly for improvements to keep pace with it. Each field of service is undergoing constant change and, through increasing use, structures are wearing out or their capacities to serve are being crowded to the limit. Constantly the addition to existing structures, renewal of portions subject to greatest wear and tear and provision of new works are required. Each day standards of living advance, stimulated by every activity, every useful invention, every worthwhile business enterprise and every progress in education. Consequently not only are public services that formerly were provided only in the larger cities being demanded in smaller communities, but also demands for improved quality of all services are being superimposed upon need for their constant expansion. We are thus compelled to build new water and sewer systems, water and sewage-purification works, new pavements, wider and better roads and larger and more extensive schools.

Tens of thousands of dangerous grade-crossings await the work necessary to eliminate them.

It is significant that in the recent cry for tax reduction there has been no serious proposal to abandon any of the established public services. The average citizen realizes that he cannot provide for himself at a cost that he can afford to pay the now indispensable services extended to him by his community. Whether it be police protection, waste collection, street pavement and lighting, water supply, sewer service, fire protection, school, bridge or flood protection, he knows that it is necessary for his security, service, general convenience and enjoyment of life. He will not

Not more than a dozen valleys in the country can point to completed flood-protection works. Upper view shows a levee in Texas under construction.

Interior of the new water-filtration plant for the cities of Youngstown and Niles, Ohio, built by the Mahoning Valley Sanitary District.

vote to assume the burden of providing any such service for himself because he recognizes that it would be impossible or prohibitive in cost in the present social scheme.

With present reduced income the citizen complains of his cost of public services and finds support for his complaint in published statistics comparing present costs with those of "the good old days." Yes, costs have increased. The increase has been the inevitable result of the profound changes in our social order, changes that make the individual and his manner of living and doing business absolutely dependent on the community as a whole and upon community and private facilities provided for his use. These changes in the manner of living fully account for the greater annual cost. But the lot of the farmer of today, sitting at the wheel of his gang-plow tractor or taking his wife by automobile to the nearest town for an evening at the movies, is certainly to be preferred to that of the pioneer. The well sweep and moss-covered bucket were picturesque, but they often delivered sickness and death. They have been superseded by our present water and sewer systems, which greatly lessen the work of household operations and protect property and health but which require constant operation, maintenance, extensions and improvements.

Neglected needs

In providing grade crossings for high-speed transportation, in flood-protection improvements, in protection of shores, in improvement of secondary and country roads and in relieving and correcting the blighted areas of growing cities, there is a great volume of accumulated needs for public works. In the past these facilities have been grossly neglected, and the consequences of that neglect is just beginning to be appreciated.

Flood protection is a primary field for public construction today. Every stream valley encroached upon by building meances life and property beyond common comprehension. Engineers have struggled through many flood periods to rehabilitate flood-damaged communities, only to be prevented from carrying to conclusion carefully planned protective works. Not more than half a dozen valleys in the country can point to completed flood-protection works, and less than a dozen others have even made a beginning toward preventing a recurrence of loss of life and property. There are probably hundreds of river valleys that have not yet experienced maximum probable floods in the period that they have been developed, and their inhabitants are basking in a false sense of security, doubly dangerous in the belief that they are out of the danger zone. Much construction of major importance, including continued maintenance of open flood channels, needs to be started now and completed at the earliest possible date.

Separation of grades for traffic crossings is somewhat more advanced than is flood protection, but tens of thousands of dangerous grade crossings await the work necessary to eliminate them. Much of our great Pacific, Atlantic and lake shore lines are unprotected against the storm destruction that causes recurring losses of many millions of dollars to improved property. Along most of the improved shore frontage we have neglected to provide even the most primitive protective needs, and private attempts to protect individual properties often effect their desires only at the expense of neighboring properties. Hundreds of thousands of miles of secondary and local roads are still unimproved, condemning the dwellers on the lands that they so inadequately serve to conditions and standards of living little better than those of a hundred years ago. Until these neglected needs for reasonable public facilities are being satisfied on some adequate program of continuous construction, there is no item of truth in a statement which denounces improvement construction as luxury or extravagance.

There are districts in all our cities that we are ashamed to exhibit to visitors, and yet little has been done to correct such conditions. People continue to exist in the blighted areas of cities under housing conditions certain to undermine health and morals. There must be public cooperation with honest private enterprise to tear down these sources of supply of inmates for jails and public charity institutions, and to substitute for them inexpensive wholesome housing facilities. Conduct of such activities might well be carried on in a spirit of competition between communities, to see which could first rid itself of the disgraceful conditions.

When public works are constructed they often create uses that did not exist before. They may have been planned with adequate provision for the then-existing possible uses, but their very existence often causes the invention of new uses that tax their capacity and try their strength to the point of partial destruction. New works of more capacity, of better materials and of greater strength must then be constructed to provide the enlarged service demand. For example, the old water-bound macadam state road was soon roughened by pleasure automobiles and was resurfaced with an asphalt binder. Heavy trucks began to use this road and soon thoroughly disintegrated it. Stronger foundations and improved surfaces were next built, and the better the road became the heavier became the traffic over it until today the most approved type of road, more than twice the original width, has completely superseded the old construction from foundations to surface. Not more than twenty years ago the waterworks in a residential community used to deliver from 30 to 40 gal. per capita per day. Now, in some similar areas, due to gas refrigerators, air-conditioning, fountains and swimming pools and universal use of lawn and garden irrigation, the per-capita use of water is three times as much. Improved knowledge, advancing standards of performance and new inventions make the original public works no longer adequate and often completely worn out from greater use than they were designed to serve. This requires new construction to reinforce or to replace present facilities.

PUBLIC WORKS PROJECTS READY FOR CONSTRUCTION

(Listed by the National Committee for Trade Recovery)

Kinds of Work	Estimated Cost	Number of Projects
Bridges and tunnels	$551,630,000	330
Sewerage and sewage disposal	288,697,000	599
Waterworks	171,934,000	718
Flood protection, irrigation and drainage	465,847,000	120
Highways	309,481,000	260
Streets and paving	107,899,000	311
Port and harbor development	145,637,000	82
Schools and libraries	153,067,000	377
Hospitals, prisons, asylums and institutional buildings	105,803,000	210
Miscellaneous municipal projects	317,853,000	439
Total (Exclusive of federal work, major highways and such semi-public work as housing)	$2,617,848,250	3,446

Specific examples

It is because of better knowledge and higher standards of cleanliness and recreation that New York City is now engaged on a program of construction of the world's largest sewage-purification works, and at the same time is building a group of refuse incinerators. It is because of the necessity of a great city to comply with improved health standards that Chicago is attempting to borrow several million dollars to build filters for its water supply and is anxiously seeking funds with which to complete the extensive works of its new Sanitary District. At San Francisco great bridges are being erected across Golden Gate and San Francisco Bay to provide better access to suburban residential areas. At our national capitol the antiquated housing of federal departments is being replaced by adequate, modern public buildings to care properly for the increasing business of the national government. So, in every part of the country, in every city and village, the public-works structures that helped the communities to grow up are falling back into the rear rank of importance, to be outclassed by new and larger structures.

The almost universal use of the motor vehicle has developed the need for many services for which no comparable need existed 30 or 40 years ago.

We are all impatient of delays, imperfections or inadequacies in our highway services, and we do not hesitate to say so. We shall continue to increase our demands for street widening, smooth pavements, extension of traffic arteries and express transportation routes and to call for bypass highways to prevent through traffic from cluttering up our business districts. We shall call for better traffic control, more parking areas, better and more easily accessible recreational areas, cleaner water for bathing, boating and fishing in our harbors and rivers. These are not luxuries, they are urgently needed. They call for extensive, coordinated planning, revised plans for financing and a large amount of construction in the immediate future.

Other changes in living conditions not so spectacular as those brought about by the use of the motor vehicle are none the less effective in demanding public-works service. In sanitation, in educational and social services, continuing and even increasing amounts of construction will be required to provide for changes in community needs for service and protection of public health and to promote general welfare.

Unless we are content to fall asleep in the orchard and dream back to the days of the old mill pond and red frame schoolhouse, we must realize that public service means the steady continuance of large-scale construction operations. As long as progress persists, public works will not be overbuilt. Today they are incomplete, and many are outgrown and antiquated. Only through early resumption of construction on our interrupted public-works program can we hope to avoid conflict with the anticipated resumption of private construction and meet the demands of a reawakened and orderly forward movement of national life and business.

The Citizen as a Stockholder in Public Facilities

Louis Brownlow

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CUSTOMER-OWNERSHIP was not invented by an electric utility company, for citizens have always been customer-owners of their public works and service facilities. What kind of balance sheet can their own corporation show? A former city manager who is a penetrating student of city affairs here says that the balance sheet reveals a high net worth.

THE CITIZEN-STOCKHOLDER is the owner of a share in the equities of the public works constructed, owned and operated by the political unit in which he holds citizenship—of those equities that can be measured by the capital investment in public works less the unamortized debt outstanding against them.

It is true that the citizen rarely thinks of himself in the capacity of citizen-stockholder. He is accustomed in considering private business, his own and that of others, to talk about the capital investment in this, that or the other enterprise, and about how much of it is represented by common stock, preferred stock, bonds, debentures and notes. He is concerned with whether or not dividends are paid, or earned, with whether or not interest is met on bonds and other obligations. But usually the word "investment" is uppermost in his mind, and he rarely talks about how much this or that particular private enterprise owes, or about how that debt is being paid off.

Considering public enterprises, on the other hand, the citizen-stockholder often thinks of himself as taxpayer or as a voter. When in this mind, he talks about the debts owed by the political unit of which he is a citizen; it is the word "debt" that is uppermost in his mind, and he but rarely thinks of his equity in the publicly owned properties.

So much has been said in the last three years, particularly, about the burden of taxation and the weight of public debt, that unless one is wary he may be led to believe that all public expenditures are a net waste—that the public money spent might as well have been thrown into the ocean for all the good it does. In the din of this chorus it is easy to lose sight of the fact that a great part of the public expenditures made in the past is represented now by sound investments of capital in public enterprises that have been and still are paying substantial dividends to the citizen-stockholders.

Balance-sheet figures not available

There are two reasons, at least, why it is unusual to state the case in terms such as I have used. One is that dividends paid to citizen-stockholders are not paid in cash directly to the individual, but indirectly in services through the community of which he is a part. The other is that public bookkeeping, being concerned much more with the debts as debts rather than with capital investments as investments, does not readily produce a balance sheet that will indicate what the citizen owns in the way of public property, the rate at which that ownership increases, how much he still owes, and what dividends are earned and disbursed in the form of services.

These things give rise to serious difficulties, for they make it impossible to present a statement of earnings and dividend disbursements, or, indeed, of equities owned, in terms of dollars and cents; pounds, shillings and pence, francs, marks, roubles, yen or zlotys—whether on or off the gold standard; they make it impossible to set up for the United States, for instance, any complete statistical statement of the capital investment in public property.

Even if we do not stress the fact that available statistics for private enterprises sometimes require explanation and interpretation, to say the least, yet it must be admitted that our public bookkeeping does not throw into high relief the facts that would interest the citizen-stockholder if he thought of himself in that capacity.

A citizen-taxpayer, a home-owner, a head of a family, in an American city is keenly aware of the fact that he pays taxes. He is consciously aware of his sense of ownership in his house and lot.

He know what he agreed to pay for it, how much he has paid, how much he still owes on the purchase price, and he follows the market up and down with estimates of the value of his equity in it. But rarely will he relate that estimate of value to those public improvements in which he, as a citizen-stockholder, owns a share. If the street system were wiped out, the pavements torn up and the public ways barred; if the public schools, the city hall, the fire and police stations and other public buildings were abandoned and the services they house discontinued, if the sewers were stopped, if the street lights were turned out, if the parks were closed—what, then, would be the value of his house and lot?

It is impossible to contemplate such a civic disaster unless we face the picture of a total social collapse. So there are certain social values that must be reckoned, but it is perhaps of little use to calculate them in terms of dollars and cents for there is no way of measuring their divisible value for the individual citizen.

Some public expenditures, it is true, have been invested in certain types of enterprises that it is possible to measure, and thus it is possible to levy a direct charge for services rendered to individuals. Such are publicly owned waterworks, electric plants and other public utilities. In some cities there is a direct charge for sewer services. All over the eastern part of the country rural highways once were privately owned and travelers were charged a toll for their use, but social complications make such a system almost, if not quite, impossible in urban areas. It has now been all but abandoned except for a few high-speed roads and some bridges, both privately and publicly owned.

The fact is, it seems to me, that Mr. Citizen-Stockholder has invested in so many different types of public enterprises that a statement of a particular investment in a particular undertaking will not present a picture typical of all his holdings.

The taxpayer as an equity owner

Let me attempt to explain my meaning. I was talking one day with a very wise and learned man who knows a very great deal about the electric industry. We were discussing the case of a small city that had paid into its treasury the earnings from its municipally owned and operated electric plant, and thus had avoided levying any taxes for city corporate purposes. He advanced the suggestion that the city had no right to use these earnings for such a purpose, but, assuming that proper charges for amortization, depreciaion, and so on, had been met, should have returned the excess earnings to the electric consumers by reducing the rates. I asked him who owned the equities in the plant. "The city, of course," he replied. "Who is the city?" "Its citizens." "Then," I went on, "if the city decided to turn its electric utility into a private instead of a public operation, could it not reasonably issue stock to its citizens in proportion to the amount of taxes that they pay?" He allowed that that would be a reasonable scheme of distribution, since the city, as a city, had underwritten the undertaking in the first place, and in default of earnings was liable to pay the interest and amortization of the bonds from taxation. "Then," I persisted, "would it have been unreasonable to permit the rate structure to stand at a level which would return something in the way of dividends to the individual stockholders?" "No," he replied. "Then what is the difference," I concluded, "if these surplus earnings are distributed directly to individual stockholders or to citizen-stockholders?"

Difficult as it is to get straight thinking about such public properties as publicly owned utilities, it is even more puzzling sometimes when we come to the types of enterprises of which there are few or none in the field of private business.

A city, for instance, invests a certain amount in a traffic-light system. The system has no segregated revenues, for the services rendered by it are available to all without measure and without price—red, amber, green. It is supported by taxes, which pay for the current it consumes, for the cost of operation and maintenance and for the interest and amortization on the bonds, if the capital cost were met in whole or in part from borrowed money. Yet without earnings that any accounting system can measure, it pays dividends that no bookkeeper will report. It may release men on the police force for other duties. It may prevent death, injury and financial loss by preventing accidents. It may save the money and time of the citizen-stockholder by expediting traffic.

Chicago, just rounding out its first century of life, has drunk the waters of life from Lake Michigan. As a city it has invested in its waterworks the tidy sum of $130,000,000. It has sucked the water in through its pumps from the cribs and poured it out of its faucets with abandon and carelessness. It has not metered its people's water connections. It has charged but little for this water so prodigally supplied. Most competent authorities will agree that Chicago ought to meter its water services, and that it ought to raise its water rates so as to provide money for additional filter plants, intakes and other improvements to its waterworks. Nor has Chicago been considered a city in which municipal management has at all times been the last word in economy and efficiency.

Yet despite these shortcomings, it remains a fact that the Chicago water users have paid not only the cost of maintenance and operation of this plant, but they have paid off most of the debts incurred to construct it, so that against its investment of $130,300,000 there is now outstanding a debt of only $17,932,000, a debt of less than 15 per cent.

Chicago is but one of hundreds of examples. Of the 10,789 waterworks systems in the United States in 1932, 7,853 were publicly owned by citizen-stockholders. In 1930, according to the Bureau of the Census, the 25 cities having more than 300,000 population had invested over 1½ billions in water systems. Analysis of the figures in Table I further reveals that against these properties owned by the citizens in these plants there are outstanding debts of only a little more than 50 per cent. Note on Table I that the citizen-stockholders in many of the large cities other than Chicago, such as Milwaukee, Washington, Boston, Pittsburgh, Minneapolis and Louisville, have little or no debt outstanding against their water systems.

The actual capitalized value to the citizen-stockholders of these water systems would probably appear very much higher if it could be calculated in the same manner as for private utilities.

TABLE I—BOOK VALUE AND DEBT OF MUNICIPAL WATERWORKS SYSTEMS

(Figures taken from "Financial Statistics of Cities, 1930")

City	Property Value	Debts	Equity	Per Cent of Equity to Total Value
New York	$468,673,036	$330,948,328	$137,724,708	27.4
Chicago	119,305,370	17,164,587	102,140,783	85.7
Philadelphia	88,966,300	46,260,000	42,706,300	48.0
Detroit	90,630,442	46,628,914	44,001,528	48.5
Los Angeles	93,969,603	50,409,011	43,560,592	47.4
Cleveland	58,499,098	30,389,589	28,109,509	48.0
St. Louis	36,090,614	12,082,000	24,008,614	66.5
Baltimore	73,120,891	31,447,870	41,673,021	57.1
Boston	23,300,000	538,000	22,762,000	97.7
Pittsburgh	50,491,744	8,623,600	41,868,144	83.2
San Francisco	87,454,271	85,751,000	1,703,271	2.0
Milwaukee	13,591,500	71,000	13,520,500	99.5
Buffalo	36,509,484	17,519,720	18,989,764	52.0
Washington	24,980,000	.....	24,980,000	100.0
Minneapolis	19,899,997	3,648,000	16,251,997	81.6
New Orleans	21,704,055	13,426,600	8,277,455	37.6
Cincinnati	24,059,030	14,657,230	9,401,800	39.1
Newark	40,129,910	22,527,000	17,602,910	44.0
Kansas City	25,000,000	13,120,000	11,880,000	47.5
Seattle	24,058,418	8,414,000	15,644,418	65.1
Indianapolis	.....	.....	.....	.....
Rochester	16,257,515	12,419,500	3,838,015	23.7
Jersey City	23,882,748	18,781,255	5,101,493	21.3
Louisville	16,000,000	1,769,000	14,231,000	88.9
Portland	27,953,958	21,724,000	6,229,958	22.2
Totals	$1,504,527,984	$808,320,204	$696,207,780	46.3

The Bonbright survey, for example, accounts for $8,982,002,219 of capital invested in the electric light and power industry. This is made up of the following items, according to the Jan. 18, 1933, issue of *Electrical World*:

Funded debt	$5,781,397,805
Preferred stock	1,438,557,188
Common stock	1,762,051,226

To arrive at an over-all capitalization figure, the aggregate of no-par stock must be capitalized in terms of the earning power of the industry. In this way the total capitalization for the electrical industry in round numbers becomes $12,509,000,000. This figure from *Electrical World* is very close to the value of the capital investment accepted by the industry and arrived at by cumulative census and budget statistics.

The income value of the waterworks systems owned by citizen-stockholders throughout the nation is illustrated in the Burns & McDonnell waterworks survey. The average cost of water delivered to consumers in quantities of 5,000 gal. per month up to quantities of 1,000,000 gal. per month ranges from 58 to 20 per cent higher in the 25 private plants than in the 225 municipal plants in cities of over 25,000 population. And the plants owned by the citizen-stockholders are nearly all making good "profits," which are used for extensions or for relieving the citizens of taxes. If the same rates were charged as by the privately owned systems, the citizen-stockholders would be piling up large profits for themselves in which they could participate through reduced costs of other municipal services measured in terms of taxes, or by cash dividends.

So valuable do public water, electric and gas utility systems prove to the citizen-stockholders as income-producing investments that in many small municipalities they have given the citizens freedom from payment of any local taxes. Earnings from these utilities are sufficient to meet all expenses of the city government, not including schools. Hundreds of other citizen-stockholders could have reduced their taxes in this way if they had not preferred, or been required by law, to apply their utility revenues toward other special improvements or toward rate reduction. As suggested at the outset of this article, it is the citizen who benefits, whether the profits reduce the rates or whether they reduce the taxes.

Public-works expenditures a huge slice of business

Although the accounting records of our cities, counties, states and national government do not provide us with an accurate statement of the net worth of public properties, a key to the total investment in public improvements by citizen-stockholders may be obtained by an analysis of public construction undertaken in the past.

TABLE II—ESTIMATED DOLLAR VALUE OF ALL CONSTRUCTION IN UNITED STATES

(Millions of Dollars)

	Residential	Public Works	Other	Total
1919	1,160	1,640	740	3,540
1920	706	1,470	1,204	3,380
1921	1,100	1,510	860	3,470
1922	1,675	1,780	1,445	4,900
1923	1,980	2,300	1,590	5,870
1924	2,120	2,500	1,610	6,230
1925	2,704	2,476	2,998	8,178
1926	2,676	2,670	3,532	8,878
1927	2,544	3,073	3,978	9,595
1928	2,796	3,480	4,304	10,580
1929	1,934	3,263	5,180	10,377
1930	1,103	3,363	3,592	8,058
1931	812	3,098	2,020	5,930
1932	281	1,918	640	2,839

Table II contains an estimate of the total volume of private and public construction of all kinds from 1919 to 1932. This table is taken from "The Statistical Picture of Current Construction" appearing in the Feb. 2, 1933, issue of *Engineering News-Record*.

Table II shows that on the average only one-third of the total construction between 1922 and 1928 was for public purposes. Since 1928 private expenditures have dropped off 88 per cent, whereas public construction has been reduced 45 per cent. Total construction in 1932 is estimated at $2,839,000,000, of which 67 per cent, or $1,918,000,000, represents public construction.

Investment from current budget is clear equity

Public contracts entered into by states, counties and cities are generally financed through borrowing. The federal government, on the other hand, has in the past followed the policy of including all such improvements under its current budget. During the ten-year period from 1919 to 1929 the federal government spent $3,280,064,727 out of its current budget for new construction. The assets this has brought to citizen-stockholders of the country consist of highways, inland waterway systems, irrigation projects, post-offices, improvements in national parks, hospitals, permanent army and navy posts, lighthouses, penitentiaries, Indian schools, Panama Canal additions and a variety of other improvements.

In some states and cities the citizens have operated their government on a "pay-as-you-go" policy, so that practically all improvements and permanent fixtures are clear equity to the citizen. The state of New York, for example, in 1928 spent $18,528,000 out of current revenues for highway construction, whereas only $448,000 was expended from bond funds for the same purpose. In other states and cities where major improvements have been paid for generally out of borrowings the debts have been steadily liquidated, so that the various properties become clear assets of the citizens.

But what of the maintenance and operating costs of these improvements that continue year after year? Are we not piling up permanent obligations that compel increased taxes to the detriment of business? In the language of a Chicago newspaper, "What is paid to the government cannot be spent for bread and butter, for education, for real estate, for bonds or for repairing the teeth." And thus we return to where we started—the citizen is encouraged to look upon himself as a tax-paying citizen or a voting citizen and not as a stockholder and participant in the services of his government.

What happens to taxes?

Largely, taxes are employed to pay salaries, and these salaries are used, as in the case of salaries paid by private enterprise, to pay for rent, to purchase food, clothes and coal, and all the other necessities of life, including "repairing the teeth." Government expenditures also purchase directly a large amount of materials, supplies and equipment of all kinds and descriptions. The purchase of cement, motor equipment, electric current or any other commodity which the citizen buys through his government—do not these purchases of the citizen as a public stockholder swell the volume of business of the vendors of these commodities just as much as purchases by those same citizens acting in their capacity as private stockholders?

The construction industry, now in the depths of despair, has depended, as noted above, for over one-third of its business upon government expenditures. One suspects that the profits to contractors from public contracts are as acceptable as profits out of contracts from private business. In fact, such public expenditures as have been made have greatly modified the effects of this depression upon business by reason of the fact that government, in supplying citizens with services, has carried on its payrolls a large number of employees who have been able to pay their rent, purchase food and buy coal, thereby keeping the wheels of business running.

In England the memories of men go back to a time when Lancashire spun and wove for the whole wide world; when the mills and their machines spawned new towns, new millionaires, new poor; when the towns that were but huddled villages stank in their filth, and disease was still a scourge of God; and, when, too, the time came that a war in a far-off land paralyzed that humming hive. The war was not in England, it was fought between the North and the South in 1861-5. It concerned the Union, slavery, many other complex things. But in Lancashire it cut off the cotton supply and there was great distress. Great measures for relief were necessary, and then the people at last had their way who for years had been pleading for public expenditures on public works for public purposes, but whose pleadings had not been heard in a time of money-making. Money was borrowed on public credit. Waterworks and sewerage systems were built, and the modern sanitary city came into existence. Only the other day an Eng-

lishman said to me that he doubted if we knew what a debt England owed to us Americans for having that devastating Civil War which hurt and crippled English private business to such an extent that England was forced to pay attention to its public needs.

England has been going through something of the same hysteria that our nation has about local government expenditures—especially since its departure from the gold standard in 1931. But there is now an observable change in opinion; and the Ministry of Health, the very body that was compelled by circumstances to order the local authorities to retrench, has now called on those same local authorities to submit for each town a five-year plan of capital investment that will wipe out all the slums in all the English cities and towns by 1939!

And we quiver with fear because after nearly a year the Reconstruction Finance Corporation has made one loan for clearing a tiny bit of one of the slums of one city!

The investment that was made in public works by the Lancashire towns in the 1860's has long ago been amortized—the debt then created has been paid off. But the citizen-stockholders are still getting dividends—dividends that never are passed—in the greater conveniences and amenities of living, in living longer lives and in living lives of infinitely more happiness, of infinitely less pain, even during the black years of this depression.

Conserving Savings by Investment in Public Works

Willard Chevalier

Publishing Director, Engineering News-Record, New York

QUITE BEYOND their function as service necessities, public works have a remarkably important mission that so far has received little consideration. They are, as Colonel Chevalier says, the shock absorbers of excess savings—those savings that must not be invested in extending industry's productive plant if we would avoid periodic bankruptcy crises.

FIFTEEN or twenty years ago a book on elementary economics was published, under the striking title "How the World Makes Its Living." This title has come back to my mind frequently amid all the tumult and controversy of the last few years over capitalism, profits, private property, technology, the gold standard, budgets and all the rest. For, after all, our economic institutions are man-made for the one purpose of enabling the world to make its living.

It will be obvious that the world can make its living only as individuals are able to make their living. So when some twelve to fifteen millions of our fellow citizens are unable to find employment, when through no personal fault they are unable to make their living, it is evident that our economic system somehow has fallen pathetically short in the one essential criterion of performance.

Unemployment is the essential problem

Unemployment is our essential problem and the stimulation of employment is the key to its solution. Our position is the more deplorable when we contemplate the fact that we are suffering from an excess of plenty rather than from a scarcity. One set of our people is unemployed and in want because another set cannot buy its produce; the other set is unemployed and in want because the first set cannot buy *its* produce. On the one hand we have vast productive capacity; on the other an infinite desire and capacity to consume. Something in our machinery comes between these complementary forces and prevents the free exchange that is essential to distribute the produce of our genius and our energy.

The economic health of the community, depends upon a nice balance between (1) that part of the national income which is spent to create consuming power, (2) that part which is invested to create producing power and (3) the use of credit, which, of course, is simply the advance spending or investment of anticipated earnings.

Spending and investing

If we spend more than we should, we are unable to maintain the facilities required for efficient production, make good wear and tear, replace inefficient and out-of-date equipment, build more modern factories or equip new industries. We then are headed for a crisis of scarcity with consequent impoverishment. On the other hand, if we save and invest too much we are in danger of increasing our productive capacity more rapidly than we can find consumers for our produce. A surplus of savings pressing for investment results in over-expansion, excessive use of credit, inflation of costs, destruction of profits and eventual collapse, which destroys not only the possibility of earnings but also the value of the investment itself. When productive capacity outruns consuming power, we are headed for a crisis of excess, with unemployment and consequent impoverishment.

Industrial expansion

During the last 140 years the United States has given a striking demonstration of this system at work. We have had a vast area and vast resources in one economic unit to exploit and to equip. In order to create the industrial plant necessary to do this, we have developed to a high pitch the doctrine of saving and investing our surplus in some form of reproductive enterprise. During this time we have established a national psychology and a financial structure that has pumped our surplus and the credit based upon it into new facilities that would in turn produce more commodities and services to be sold at a profit and thereby reproduce the original capital.

Until recently we have been able to prosper mightily in this process. Our growth in area and in population has called constantly for more goods and services and has enabled us to recover

readily from the periodical process of deflation and readjustment. It has produced the wealth necessary to provide the required capital facilities, and has enabled us to wipe out our foreign debt and become the world's creditor. We have built the greatest production plant in the world, developed a science of production efficiency and achieved a productivity per worker that are the envy and the despair of the rest of the world.

But today we are beginning to question seriously whether the time has not come for us to make a new estimate of the situation. Having progressed from a state of scarcity to one of abundance, we suddenly discover that we must deal unexpectedly and under pressure with a situation that should have been developed over a generation. Naturally, the problem ranges the entire scale of economic interest, but this is neither the time nor place to consider all of its phases. Here we may touch only upon one—the place that public investment in fixed facilities may play in the process of recovery and readjustment.

Employment in building capital facilities

It will be evident that the employment created by the constant conversion of our savings into capital facilities has been one of the chief means by which we have provided the additional purchasing power required to consume the ever-mounting domestic production of consumable goods and services, and simultaneously have limited the amount of our excess production. As a result of this, the whole business structure of our country is proportioned to this volume of trade, and when anything happens to curtail or suspend investment in fixed wealth the effect upon current trade is disastrous. The manufacture of the materials and equipment required for our capital structures and works, the generation of the power used in their production and installation, the process of installing such facilities of every sort, provide so substantial a share of all the wages and salaries paid to our people that there can be no balance and hence no prosperity in the United States without a substantial program of capital investment.

We are then confronted by this dilemma: How can we continue to increase our productivity and convert the surplus wealth thus created into current consuming power without adding excessively to our productive capacity? Or, in another form, if our new command of machinery and power is going to reduce more and more the relative amount of fixed capital required for the production of the necessary consumable goods and services, how are we going to conserve or consume advantageously the surplus wealth we are able to produce?

It is essential, of course, that whatever course we may select, we must maintain the reproductive principle in so far as may be necessary to provide new capital for three purposes: (1) to make good the depreciation of productive equipment; (2) to replace obsolete equipment; (3) to provide the necessary additional facilities for existing and new types of business enterprise required by our growth or made possible by the developments of science and invention. But, as is becoming increasingly apparent, *the remainder of our production should be converted directly into consuming power as rapidly as it is created,* rather than invested on a profit-making or reproductive basis in some form of additional productive capacity or speculative enterprise.

If we balk at the idea of devoting to current consumption or non-reproductive use an increasing portion of our mounting profits of prosperous times, it is in order to ask how much better off today are those who accumulated large surpluses between 1924 and 1929 than they would be it they had converted a portion of those surpluses into consuming power for their products and thereby withheld them from possible competitive investment.

How to accomplish this? Many plans have been proposed but there is reason to believe that our investment in public works and facilities offers about the most secure and effective stabilizing agency available for this purpose.

Investing savings in public facilities

Expenditures for public works are productive but not reproductive. They provide employment and markets for materials; they do not increase the supply of consumable goods, neither do they compete with private enterprise. In general, they pay no pecuniary dividends, yet they pay untold dividends in public health, safety, convenience, comfort and all those values that make for higher standards of living.

In some cases, as with the highways, they return indirectly a generous pecuniary dividend in the form of vast industries added to our national wealth that would have no existence without them. Altogether, when the entire record is written and the accounts balanced, the American citizen may well find that his investment in public works is his most substantial actual saving, secure alike against the vagaries of the stock market, the manipulations of high finance and the evaporation of excessive industrial expansion.

Sometimes we are reminded of the alleged extravagance and dishonesty that attend public investment. But we may wonder whether an appraisal of our community facilities today would show anything near the over-investment that has attended private enterprise. It was not over-building of waterworks or sewers or highways that precipitated the crash of 1929. The record of new securities issued from 1921 to 1929 shows that public issues hovered very consistently around 1½ billion dollars annually, while corporate issues ranged from less than two billions to more than eight billions. We may reasonably surmise that the country would be better off today if the excess profits taxes had not been repealed when they were and if the proceeds had been used to pay for our public-works investment. They would have made employment without competition with private industry, would have kept the money out of speculation and over-expansion, business would have enjoyed larger markets, and today the people would have the durable wealth represented by these facilities.

It may be asked, also, whether all the petty depredations of all the grafting politicians have cost the American consumer and investor nearly as much as did the operations of Mr. Insull and Mr. Kreuger. And it should be remarked in this connection that these gentlemen are not unique; they simply were unfortunate.

New and flexible fiscal policies needed

It is true that we have not as yet learned how to handle the fiscal aspects of our public investment so that we can realize the maximum stabilizing effects upon consumption and employment. But when we shall have developed a more modern and flexible fiscal system so that we can assess the cost of community services more directly upon those who enjoy them, charge real estate more equitably for improvements that enhance its value, and finance public works more consistently out of taxation upon surplus earnings and excess profits, we shall begin to see this more clearly. All this will come; to those who will look beneath the surface it is implicit in every move that is being made today to reconstruct and restore a workable national economy.

Meanwhile, we must use what we have. We must anticipate the earnings of a restored American industry, and finance our public-works program by borrowing on the public credit. Thus only can we provide employment, stimulate consumption and help to resume the capital investment that is so essential a factor in our national economy. At the same time such investment in public facilities will conserve the wealth we put into them against the needs of our communities as they resume their growth and prosperity.

Is it too much to hope that we shall learn from this experience to use our public investment hereafter as a means to absorb our surplus earnings, control our investment in productive capacity, stabilize our consuming and purchasing power and insure the continued useful employment of our people, which is the ultimate test of our economic system?

BUSINESS ASPECTS OF PUBLIC CONSTRUCTION

RELATION TO GENERAL BUSINESS—*F. S. Baldwin*
THE CONSTRUCTION INDUSTRIES—*Edward J. Mehren*
EFFECT ON LAND VALUES—*Lawson Purdy*

THE NATION looks to public construction as the most powerful means of reactivating stagnant industry. What have economists and business leaders to say? • They show that construction lies at the heart of industrial life, that it is the country's greatest activity next to agriculture. It employs millions of men and converts idle credit into a circulating stream of productive money. • The effects of construction ramify far because of its widely distributed supply industries. One-fifth of all railroad activity depends on it. Property values are increased by it. • In a depressed world, public construction has power to revitalize business.

What Public Construction Means to General Business

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BY WAY of approach to the discussion of what public construction means to general business it will be helpful to sketch in the background of the picture. Public construction is a major branch of the complex of activities that make up the building industry. In a very real sense this industry is fundamental to all other industries and activities. It influences every phase of the nation's economic and social life.

The great complex of economic activities, collectively termed the building industry, includes the construction, maintenance and management of houses, apartments, hotels, office buildings, factories, stores, warehouses, churches, hospitals, theaters, public buildings, docks, waterways, sewerage and water systems, roads, bridges, railways, public utilities, and all the other diversified structural equipment of the modern economic and social system. It gives employment to over 3,000,000 persons, from engineers and architects to construction workers, and in addition calls into action many other industries that manufacture building materials, equipment and furnishings, provide transportation for these structural accessories, and supply heating and lighting facilities, telephones and other goods or services. Furthermore, the cost of construction and maintenance of factories, offices, and public buildings enters into the cost and so influences the prices of all commodities and services. Finally, through the cost and rental of homes the building industry influences the cost of living of the entire population and is a determining factor in the standard of living and the social life of the nation.

The general significance of the building industry in the economic and social life of the nation and in relation to the problem of recovery from the present depression was fittingly set forth in a recent address before the New York Building Congress by Virgil Jordan, President of the National Industrial Conference Board:

"It can truly be said that the story of the economic development of this country is the story of construction in the broad sense of the word. Every period of rapid expansion of prosperity has been based upon some aspect of construction, first of the railroads, then of industrial plants, then of public utilities, roads, automobiles, urban apartment and office building, and suburban residential building. In the rapid expansion after the post-war depression of 1921 the influence of residential building, the automobile and road construction are inseparable. That expansion has not come to an end; it has only been rudely interrupted by this catastrophic accident which we call the depression of the '30's. The vast expansion of the service industries centering in construction, which accompanied the prosperous period from 1922 to 1929, has barely started. . . .

"The American people are still living in the covered-wagon stage of construction, a pioneer people squatting in a series of frontier mining camps as though they were going to move on tomorrow. A few thousand miles of surfaced roads built in the last few years, fringed with filling stations and hot-dog stands, stretch between these squalid camps. We have still to build an America worthy of the enterprise and aspirations of our people, and we may be sure that when we do we shall have to build it again and again because everything we build for one generation will be obsolete for the next."

Some statistical exhibits

Its size—The magnitude of the construction industry may be illustrated by presenting briefly some of the more significant statistical data relating to pro-

duction and employment in major industries. The statistical tables and charts accompanying the text were prepared by the editorial staff of *Engineering News-Record*.

Major industries, including agriculture, measured by the net value of finished goods in 1929, compare as shown in Table I and Fig. 1. It will be seen that the construction industry ranks second only to agriculture; that it is nearly double the textile industry; more than double the iron and steel industry; and more than 3 times the petroleum and coal industries.

Since 1929 the annual volume of construction has declined rapidly. From the peak year, 1928, it fell to $2,839,000,000 in 1932, a decline of 76 per cent. The volume of construction in the last year fell below the level of the previous depression period, 1921-1922. Public construction increased in 1930 but thereafter fell, the total decline from 1928 to 1932 amounting to 45 per cent.

Employment—Statistics of employment in the construction industry (Table II) show that the total number of persons gainfully employed in construction in 1929 was 3,310,924, which figure includes 167,512 contractors and 227,172 professional men. Employment in other fields is shown in Table III.

The Construction Census of 1930 brought together a mass of highly informative data concerning the construction industry and contracting operations in the United States. This detailed information throws much light on the important rôle played by the construction industry in stimulating activity in related fields. Significant data from the census report are summarized in Tables IV to VI; the figures relate to the year 1929. The census returns covered 30,597 contractors, having a total business of $6,250,267,000, including $4,794,733,000 done by their own forces. About 60 per cent of this business was done by 12,556 general contractors (Tables V and VI).

The volume of business done by the 3,500 public-works contractors totals $1,081,512,000, or about 30 per cent of the business of the entire group of general contractors. They reported a slightly different distribution of expenditures from that of all contractors.

A significant fact is that the construction industry distributes 83 per cent of the money spent to employees and to other industries, including bond interest and insurance—and retains only 17 per cent for other operating expenses and profits. (See Fig 2.)

Its Penetration Into Industry—The importance of the construction industry, as previously pointed out, does not rest solely on the magnitude of its operations, the value of the structures that it creates, and the volume of direct employment provided. Its influence in the economic life of the nation extends widely beyond its own immediate field. This penetrating influence makes itself felt primarily through the enormous demand for materials and equipment, and for transportation services. The major materials and machinery used in 192[illegible] reached $4,500,000. (See Table VII.)

Transportation—The volume of railroad freight traffic involved in the 192[illegible] transportation of construction materials and machinery (Table VIII) totals 6,901,696 carloads, 463,444,581 tons, and yields a revenue of $630,690,721. These are large elements of railroad freight traffic, as portrayed graphically in Fig. 3. Here also a large volume of employment is contributed.

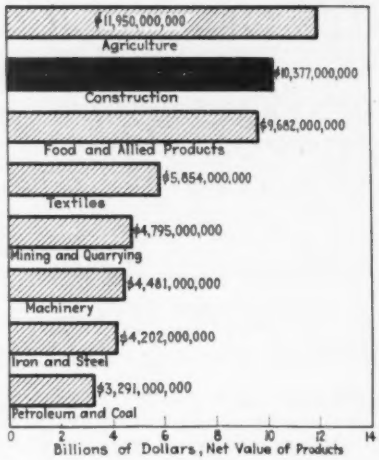
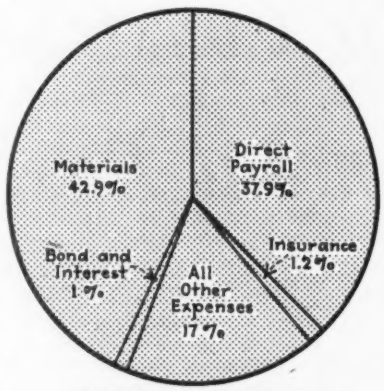


Fig. 1—The construction industry stood second to agriculture in net value of products in 1929, which was a peak year for most industries but a decline from the peak in construction.



DISTRIBUTION OF THE CONSTRUCTION DOLLAR

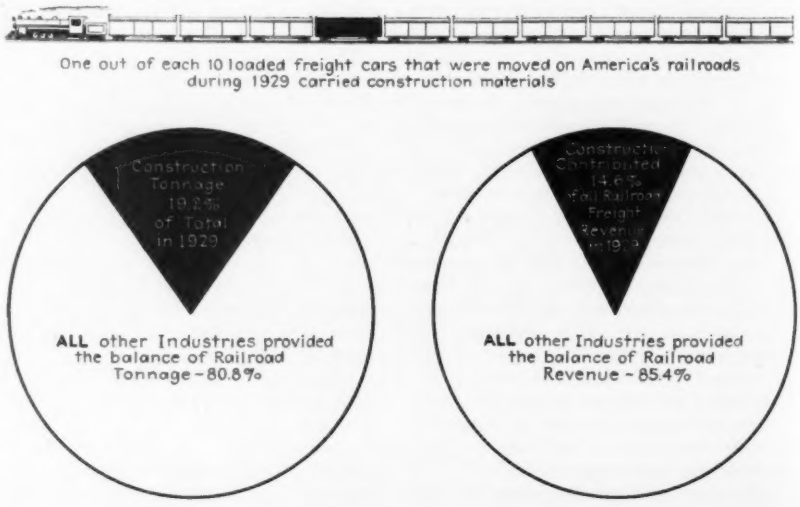
Fig. 2—The construction industry "keeps" only a small percentage of the money spent on construction. Figures are based on the reports of 30,597 contractors for 1929.

Importance of public construction

Since the importance of public construction has been magnified unduly by some and minimized excessively by others, this brief survey will endeavor to present and interpret impartially the available facts bearing on public construction in relation to general business.

Much of what has already been said regarding the importance of the construction industry in general applies in modified degree to public construction, which constitutes a large part of that industry—nearly one-third in 1929. Indeed, it is a mistake to regard public construction as something altogether different, distinct and separate from private construction; the two are mutually interrelated, and each influences the other. On the one hand, the development of public undertakings leads to some private residential construction through the spending of employees engaged on public works. More important than this factor, however, is the general stimulus to private construction that results from the execution of public-works programs. The more roads, bridges, sewerage systems, parks, public buildings, recreational facilities, and the like that are provided through public construction, and the more city and town

Fig. 3—A large share of railroad business is accounted for by the transportation of construction materials.


One out of each 10 loaded freight cars that were moved on America's railroads during 1929 carried construction materials
Construction Tonnage 19.2% of Total in 1929
ALL other Industries provided the balance of Railroad Tonnage - 80.8%
Construction Contributed 14.6% of Rail Railroad Freight Revenue in 1929
ALL other Industries provided the balance of Railroad Revenue - 85.4%

planning that we have, the more reconstruction and new construction of private dwellings, apartments, office buildings, stores, and amusement structures will be demanded and undertaken. On the other hand, the expansion of private residential, commercial, and industrial construction requires enlarged community facilities, to be provided by public construction. Private residential construction developments, especially, result in a demand for more public buildings and improvements. In short, public and private construction are not competitive but complementary.

The importance of public construction is well shown by the fact (Fig. 4) that in 1929 it was greater than the total production of nine important industrial groups, including, among others, chemicals and allied products, printing and publishing, transportation equipment, forest products, paper and leather. This estimate of the 1929 volume of public construction ($3,263,000,000), it may be noted, is slightly less than that of Dr. Leo Wolman, who in his "Planning and Control of Public Works" placed it at $3,500,000,000.

The total employment in public construction in 1930 (based on the incomplete estimate of 3,300,000 men for all construction) may be figured as at least 1,300,000, the volume of materials as $1,700,000,000, and the freight revenue as $210,000,000. Since 1929 the relative importance of public construction has increased, because private construction declined very sharply, while public-works projects were pushed forward in the effort to combat unemployment. See Fig. 5.

The proportion of federal public works to total public construction has increased markedly since 1929, for while federal construction expenditures have been increasing, state and local government expenditures have been declining.

The case of the advocates of public-works programs as an aid to business recovery rests on facts such as those presented above, as well as on the widely pervasive, penetrative and stimulative influence of construction activities on general business. Public-works programs considered as a remedy for depression or "means to prosperity," to use the apt phrase of John Maynard Keynes, may be said to involve three objectives, closely related and yet logically distinguishable. These may be described as follows:

(1) To provide immediate relief of unemployment.

(2) To arrest the decline in construction and in business activity generally—in other words, to apply the brakes to the accelerating downward movement generated by the depression.

(3) To reverse the downward trend of construction and business and start an upturn, thus giving the needed initial impetus to the forces of economic recovery.

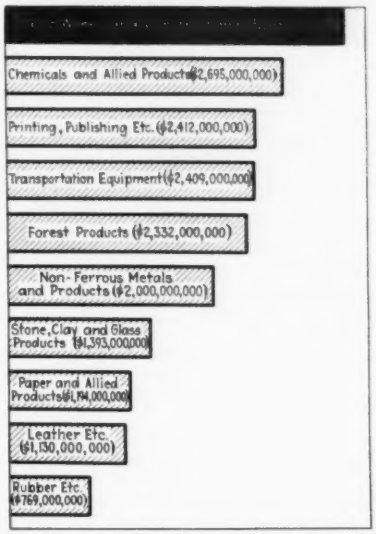

Chemicals and Allied Products ($2,695,000,000)
Printing, Publishing Etc. ($2,412,000,000)
Transportation Equipment ($2,409,000,000)
Forest Products ($2,332,000,000)
Non-Ferrous Metals and Products ($2,000,000,000)
Stone, Clay and Glass Products ($1,393,000,000)
Paper and Allied Products ($1,194,000,000)
Leather Etc. ($1,130,000,000)
Rubber Etc. ($769,000,000)

Fig. 4—Public construction during 1929 exceeded in net value the total output of each nine of the nation's important industries.

Objections to the proposal of public works as a remedy for the depression have been raised both on economic and on fiscal grounds. Discussion of the subject may well start with consideration of the objections.

Alleged economic objections

The public-works remedy for unemployment has been criticized as artificial and superficial in its working. It has been termed an emergency expedient of limited efficacy. Those who hold this view contend that public construction projects merely provide temporary employment for comparatively small numbers of workers, but do not effect a permanent absorption or reintegration of the great mass of the unemployed into the economic system.

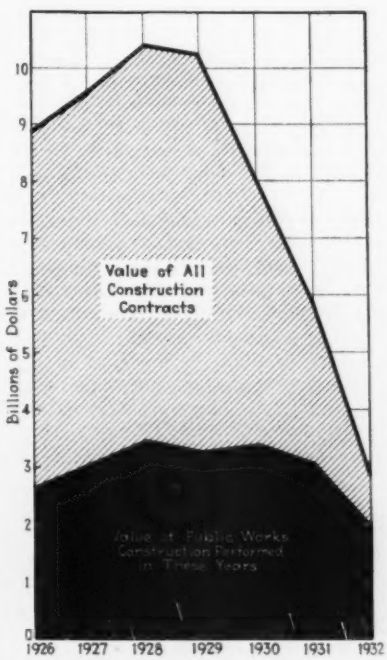


Fig. 5—Yearly value of construction contracts for the past seven years.

This view of the relation of public construction to employment and business activity is shortsighted and mistaken. It overlooks entirely the cumulative effects and multiple repercussions of public-works undertakings on general business. The critics take into account only the direct employment on the construction work and ignore the indirect effects on employment in other industries and localities, which are much more important. In estimating the amount of employment created by any new capital expenditure on public construction, the following elements must be taken into account:

1. The amount of labor directly employed on the job.
2. The additional employment in industries supplying materials used in the work—lumber, cement, steel, brick, stone, metal, and so on, and machinery—concrete mixers, tractors, engines, pneumatic tools, pumps, and excavating, dredging, and road building machinery.
3. The increased employment in transportation of materials and machinery.
4. The new employment in other contributory industries, such as electric appliances, plumbing fixtures, telephone connections, and the like.
5. The increase of employment stimulated by the purchases of the newly employed or re-employed in construction work and in other industries affected, which create demand for commodities and services to be supplied by various other industries.
6. The similar expansion of employment due to the increased spending of those employed to supply the commodities and services required by the newly employed or re-employed in construction and related industries.
7. Finally, allowance must be made for the factor of leakage along the line of increasing expenditures by the newly employed or re-employed. Not all the increased income at each stage is passed on in increased employment. For example, some of it is saved; some is spent on imports; some of the new spending raises prices and thus reduces consumption; some is merely a substitution for previous spending out of savings or public or private charity.

The net effect on employment of the series of repercussions set in motion by capital expenditures on public construction has been worked out mathematically by Mr. Keynes, who is the most con-

spicuous advocate of public-works programs as an aid to economic recovery. In a recent article (London *Times*, March 13, 1933) Mr. Keynes estimates the amount of additional loan expenditure required to stimulate one man-year of employment—that is, to put one man at work for one year—at £150. This figure contrasts with the usual estimate of £500. The latter figure, however, is based on the amount of labor directly employed "on the spot." When allowance is made for the additional employment on account of materials and transportation, the amount of capital expenditure on construction work required to create one man-year of employment is estimated usually at £200. On this basis, £500 would provide 2½ man-years of employment. This total of direct employment plus employment in materials and transportation is termed by Mr. Keynes "primary employment." Further, when the repercussions of the new capital expenditure on employment in other fields and the resulting increases in consumer spending are taken into account, Mr. Keynes finds that the estimate of the amount of employment created by such expenditure should be increased by a multiplier of 1½, to allow for this additional employment, which he terms "secondary employment." All this means that a capital expenditure of £500, instead of providing employment for 1 man for 1 year, would stimulate 3½ man-years of employment, primary and secondary. In arriving at the estimate of a multiplier of 1½ for secondary employment, Mr. Keynes makes due allowance for the factor of leakage, which has previously been explained. He sums up his conclusions as follows:

"My own estimate, taking very conservative figures in the light of present circumstances, makes the multiplier (for secondary employment) to be at least 2. But, since I am anxious not to overstate what will be a sufficiently striking conclusion anyhow, let us take it at 1½—i.e., that two men employed by loan-expenditure lead indirectly to the employment, not of two further men, which represents my own belief, but of one further man. I do not think that anyone who goes through the detailed calculation can bring it out at less than this; which means that additional loan-expenditures of £200 on materials, transport and direct employment puts, not one man to work for a year, but—taking account of the whole series of repercussions—1½ men (that is, a multiplier of 1½). It follows that the loan-expenditure per man-year of employment is not the figure of £500 with which we began, but £133. Let us, however, in order to give ourselves a further margin of safety, take £150 as the amount of additional loan-expenditure required today to stimulate a man-year of employment." (This reduces the multiplier for secondary employment to 1½).

TABLE I — TOTAL CONSTRUCTION IN THE UNITED STATES IN 1929
(*Engineering News-Record* estimate)

In millions of dollars

Public Construction:	
Waterworks	118
Sewers	209
Public bridges	237
Earthwork, irrigation, waterways	205
Streets and roads	1,294
Public buildings	878
Public, unclassified	322
Total public construction	3,263
(Federal $289; state and municipal $2,974)	
Private Construction:	
Private buildings	75
Industrial buildings	1,085
Commercial buildings	3,323
Private, unclassified	697
Total private engineering	5,180
Residential	1,934
Total private construction	7,114
Grand total	10,377

TABLE II — EMPLOYMENT IN THE CONSTRUCTION INDUSTRY, 1930
(Compiled from Occupation Statistics, U. S. Census)

Builders and building contractors	167,512
Architects	22,000
Designers and draughtsmen	100,430
Civil engineers and surveyors	102,086
Apprentices to above	2,656
Professional services, total	227,172
Brick and stone masons and tilers	170,903
Carpenters, exclusive of cabinet makers, etc	929,476
Stationary engineers (⅓ total number)	128,343
Crane men, hoist men, etc	60,886
Plasterers and cement finishers	85,480
Roofers and slaters	23,636
Structural iron workers	28,996
Skilled workers, total	1,427,720
Operatives building industry	50,684
Laborers, building and general	1,115,667
Laborers and foremen, road building and repair	322,169
Common labor, total	1,488,520
Total gainfully employed in construction	3,310,924

TABLE III — STATISTICS OF GAINFUL EMPLOYMENT, 1930
(Compiled from Occupation Statistics, U. S. Census)

	Number Employed
Agriculture	10,471,998
Manufacture and mechanical industries	14,110,652
Mining and extraction of minerals	984,323
Transportation	3,843,147
Trade	6,081,467
Public service—police, firemen, soldiers	856,205
Professional services	3,253,884
Domestic and personal service	4,952,451
Clerical occupations	4,025,324
Forestry and fishing	250,469
Total gainfully employed	48,829,920
Construction (from Table II)	3,310,924

TABLE IV — CLASSIFIED EXPENDITURES OF 30,597 CONTRACTORS, 1929
(U. S Construction Census)

In thousands of dollars

		Per cent
Wages paid	1,467,541	30.6
Materials used	2,055,595	42.9
Salaries to proprietors	35,933	0.7
Salaries to employes	312,667	6.6
Rent for equipment	25,380	0.5
Rent for space	26,992	0.5
Interest	30,962	0.6
Contract bond	20,674	0.4
Insurance	54,023	1.2
Other overhead	359,911	7.5
Not accounted for	405,092	8.5
Total Construction	4,794,773	100.0
Subcontracts let to firms not reporting	116,993	
Total work under general contract	4,911,766	
Subcontracts let to firms reporting business done as under subcontract	1,338,501	
Grand Total	6,250,267	

The net result of Mr. Keynes' calculations is that £500, the usual estimate of the amount of capital expenditure required to provide one man-year of employment, will create 3½ man-years of employment and that it takes only £150 to make one man-year.

Mr. Keynes' figures have been challenged by various critics. In the April 1, 1933, issue of the *New Statesman and Nation* Mr. Keynes made a vigorous rejoinder and threw out this tough morsel for his critics to chew on:

"Why should this method of approach appear to so many people to be novel and odd and paradoxical? I can only find the answer in the fact that all our ideas about economics, instilled into us by education and atmosphere and tradition, are, whether we are conscious of it or not, soaked with theoretical presuppositions which are only properly applicable to a society which is in equilibrium, with all its productive resources already employed. Many people are trying to solve the problem of unemployment with a theory which is based on the assumption that there is no unemployment. . . . These ideas, perfectly valid in their proper setting, are inapplicable to present circumstances, which can only be handled by the less familiar method which I have endeavored to explain."

The estimate of Mr. Keynes that £500 expended on public construction would provide direct employment for 1 man for 1 year and directly or indirectly would stimulate a total of 3½ man-years of employment is in fairly close correspondence with a computation recently made by Dr. H. C. Dickinson, president of the Society of Automotive Engineers, which indicates that the increase of national income resulting from the re-employment of a given number of workers would be three times the wages of those re-employed.

According to Mr. Keynes' calculations, an expenditure of £150 on capital works in England will create 1 man-year of employment. If we convert £150 into dollars on the basis of $4 per pound, we get $600. Allowance must then be made for differences in wage and price levels between the two countries. Without going into refinements, let us add, roughly, $400, or an allowance of two-thirds, on account of higher wage and price levels in the United States. This gives $1,000 as the unit of capital expenditure required to provide one man-year of employment in the United States. On this basis, a government expenditure of $1,000,000,000 on public works would furnish employment directly and indirectly to 1,000,000 men for one year. In other words, every billion dollars expended by government on public construction projects would create 1,000,000 man-years of employment. This estimate is to be regarded only as a rough indication of the net effect of a given amount of public-works expenditure in this country in expanding

TABLE V — CLASSIFIED EXPENDITURES OF 12,556 GENERAL CONTRACTORS, 1929
(U. S. Construction Census)
In thousands of dollars

Item	All General Contractors (12,556)	Building Contractors (8,826)	Railroad Contractors (119)	Power Plant Air Transport, Oil and Gas Line, Miscellaneous Contractors (111)	Public Works Contractors (3,500) Amount	Public Works Contractors (3,500) Per Cent of Total
Wages	803,886	455,804	26,853	44,758	276,471	28.1
Materials	1,046,664	586,199	19,851	61,193	379,421	38.5
Salaries to proprietors	13,481	9,531	115	83	3,752	0.4
Salaries to employees	171,483	97,744	4,592	11,169	57,978	5.9
Rent for equipment	17,952	3,860	1,002	535	12,555	1.3
Rent for space	11,407	6,806	200	803	3,598	0.4
Interest	18,298	8,576	295	1,630	7,797	0.8
Contract bond	16,811	6,173	303	233	10,102	1.0
Insurance	33,759	16,637	1,177	1,329	14,616	1.5
Other overhead	203,137	55,466	9,961	8,983	128,727	13.1
Unaccounted for	....	....	....	....	....	8.9
Total Work	2,539,348	1,344,919	71,317	141,070	982,042	100.0
Subcontracts let	1,164,167	1,016,007	10,029	38,661	99,470	....
Total	3,703,515	2,360,926	81,346	179,731	1,081,512	....

TABLE VI — MATERIALS USED BY GENERAL CONTRACTORS, 1929
(U. S. Construction Census)
In thousands of dollars

Item	All General Contractors	Building Contractors	Railroad Contractors	Power Plant Air Transport, Oil and Gas Line, Miscellaneous Contractors	Public Works Contractors Amount	Public Works Contractors Per Cent of Total
Sand, gravel	149,429	37,525	3,582	2,460	106,862	30.1
Cement	127,508	41,998	1,782	2,233	80,495	22.6
Lumber	101,531	81,761	1,690	2,006	16,074	4.5
Structural steel	64,730	27,894	4,186	3,648	29,002	8.2
Reinforcing	42,892	19,331	1,209	3,292	19,060	5.4
Brick	50,974	43,414	84	619	6,857	1.9
Pipe, metal	25,089	6,619	121	7,087	11,262	3.2
Pipe, drainage	18,840	968	115	511	17,246	4.9
Bituminous paving material	23,601	508	72	46	22,975	6.5
Roofing and sheet metal	6,722	6,207	34	110	371	0.1
Millwork	41,654	41,132	3	55	464	0.1
Total materials	858,293	433,496	14,843	50,253	354,701	....

TABLE VII—PRODUCTION VOLUMES OF MATERIALS AND MACHINERY, 1929
(U. S. Census of Manufactures)

	Volume in value	Per cent of total
Materials:		
Cement	$267,509,260	6.30
Brick and tile	189,965,557	4.50
Lime	27,145,443	0.60
Concrete products	85,719,885	2.35
Wall board and plaster	70,662,746	1.70
Building stone	143,633,068	3.40
Forest products	2,052,452,163	48.75
Sand and gravel (Bureau of Mines)	106,950,151	2.50
Iron and steel	1,215,992,663	28.80
Asphalt, etc. (Bur. Mines)	53,396,622	1.20
Total	$4,210,427,556	100.00
Machinery:		
Concrete mixers	$11,404,923	....
Tractors, engines, waterwheels, etc.	35,434,793	....
Hydraulic machinery, etc.	10,081,781	....
Pneumatic tools and compressors	45,029,941	....
Pumps and equipment	59,310,169	....
Excavating machinery	57,103,248	....
Roadbuilding machinery	30,693,707	....
Dredging machinery	3,641,599	....
Total	$262,700,341	....

All products of industry = $47,243,000,000

directly and indirectly the volume of employment.

Opposition on fiscal grounds

Public-works programs involve large bond issues at a time when the bond market is demoralized by the business depression. The effect, it is argued, is to raise the rate of interest on future government borrowings, to depress the values of outstanding securities, private as well as public, and thus to embarrass financial institutions and insurance companies through the depreciation of their investment holdings, and to impair and jeopardize the people's savings.

It must be recognized that this objection carries weight. But it must also be recognized that purely fiscal and economic considerations may be outweighed by considerations of practical expediency or necessity that are paramount in a period of depression like the present. Necessity knows no law, economic or other, and emergency respects no theory, authority or precedent. A realistic appraisal of the situation now confronting the nation must lead to the conclusion that federal borrowing on a large scale for long-range construction projects, nothwithstanding the obvious fiscal disadvantages of such a policy, may be justified as an emergency measure of last resort. The present emergency is extraordinary and unprecedented. It calls for unusual, and perhaps untried, measures to provide immediate relief and to promote permanent recovery. In this time of unparalleled stress, we cannot be guided wholly by the experience of the past.

It should be emphasized, however, that the federal government should set its financial house in order before entering on any large program of public works financed by government loans. The President has already taken decisive steps to balance the budget, has effected drastic reductions in expenditures, and has given evidence of a resolute determination to place the federal finances on a sound basis, and to restore and maintain public confidence in the good faith of the government and in its credit standing. Under these changed conditions there would seem to be no good reason why the federal government should not use its credit, once it has been firmly re-established, to assist in financing a comprehensive nation-wide program of public construction projects, federal, state and local. Federal aid is imperative and indispensable in connection with such a program. Without it nothing substantial could be accomplished. The federal government is the only agency that has the credit resources and broad powers needed for this great undertaking.

Conclusion

It appears that the objection to public-works programs on the score of the alleged meagerness of the employment thus created is not supported by analysis of the series of repercussions on production and consumption stimulated by the initial expenditure. Every public construction project sets in motion a series of employment stimuli that radiate widely in various directions. The net effect is to create directly or indirectly a total volume of new employment or re-employment that is estimated to be about three times as large as the amount of direct employment initially provided by the capital expenditure. Consideration of the widespread economic gain thus resulting from public construction undertakings warrants the expectation that a comprehensive federal program of public works would prove to be a most effective stimulant to business recovery. The fiscal objections to such a program have been greatly weakened by the drastic measures already taken to balance the budget and rehabilitate the federal finances.

TABLE VIII— TRANSPORTATION OF CONSTRUCTION MATERIALS AND MACHINERY, 1929
(Computed by *Engineering News-Record* from I. C. C. Report.)

Construction Materials:	Total Freight Traffic — Car Loads	Tons	Revenues Resulting
Gravel and sand	1,928,565	103,037,479	$69,420,039
Stone, finished	73,160	2,269,537	4,053,601
Asphalt, natural, by-product petroleum	201,633	6,888,441	13,712,061
Forest products — poles, posts, piling, lumber, shingle, laths	4,240,458	111,922,426	269,738,566
Cement, building	1,230,480	46,369,418	68,083,562
Building woodwork	73,395	1,382,148	4,715,515
Building paper and roofing	206,555	4,575,169	12,183,396
Brick, building tile, drain tile, etc.	1,088,096	34,566,434	51,967,950
Lime and building plaster	392,764	9,732,514	17,220,870
Iron and steel, structural and pipe	950,436	33,491,791	81,157,471
Machinery	515,654	9,210,174	39,437,690
	6,901,696	463,444,581	$630,690,721
	Car Loads	Tons	Revenue
Grand Total, All Carload Freight	71,064,426	2,389,171,483	$4,451,890,050
Construction materials, per cent of total	9.7	19.2	14.6

Note — Figures do not include coal, coke, iron ore, fuel, and basic raw materials

There is general agreement that "something must be done" to create employment and stimulate business. A comprehensive program of public construction involving large capital expenditures by federal, state, and local governments appears to be the most practical and promising method that has been proposed for providing large-scale employment and stimulating business generally. This plan has not yet been tried. It looks like the one best bet.

Construction-Materials Industries Penetrate the Nation

Edward J. Mehren

President, Portland Cement Association

PUBLIC CONSTRUCTION is an essential cog of the economic machine, as Dr. Baldwin has demonstrated in the preceding article. Mr. Mehren indicates how thoroughly the construction industries permeate the entire country and create employment in remote regions. Due to their influence the public-works dollar spreads quickly through every section of the country.

CONSTRUCTION creates employment not only on the construction site itself but in the factories, mills, lumber camps and quarries where construction materials and supplies originate and are processed. Construction necessarily is more intense in big cities and in industrial areas, but the manufacturing tributary thereto is widely dispersed, in fact penetrates to every corner of the country. Indeed it is notable that in the order of their importance in the production of materials, equipment and supplies the states take quite different rank than they do as producers of manufactured goods generally.

A study of this subject was already under way when *Engineering News-Record* requested an analysis of the part these manufacturers play in the business life of the country. The work is being done at the Bureau of the Census in Washington, under the guidance of officials of that bureau, and all material collected has been compiled from its records.

The study has not progressed far enough to secure final figures, but it does show the penetration of the manufacturing branch of the industry into every part of the country. Only a little more than half of the construction-supplying industries have been scrutinized to date, and these only the manufacturing and not the raw-materials industries. Consequently it must be insisted that figures used in this article are at best only partial and preliminary and are not the important item in the discussion. The justification for their publication in incomplete form lies in the fact that they indicate the diffusion and penetration of these industries into every corner of the country. The figures for 1929 are being used because the census of manufactures for that year is unusually complete.

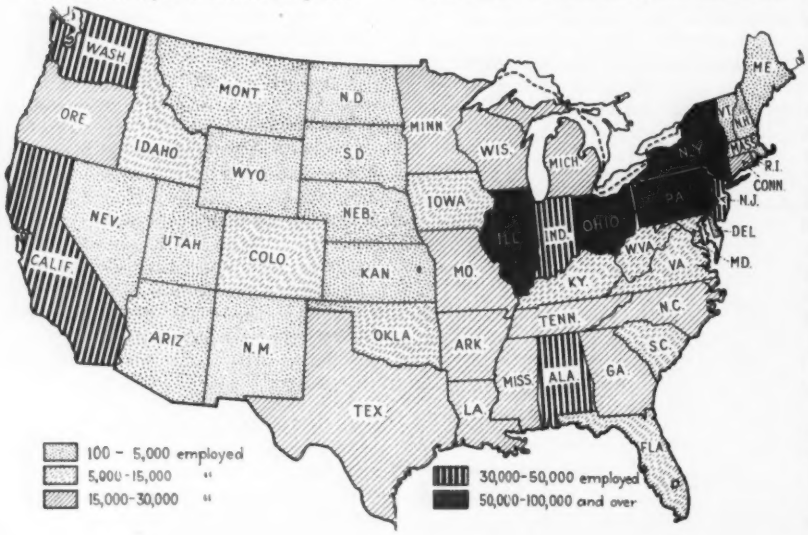
A great part of construction work is centralized in the large cities and industrial areas. But the producing units are scattered from coast to coast, and many a small town in this country has as its *raison d'être* and its life blood some construction-supplying establishment. The picture is complete when we consider that the erection of a public building in Washington, while it supplies direct labor only locally, creates employment in Oregon and Mississippi sawmills, in Connecticut hardware factories, in Pennsylvania steel mills and in Wisconsin sanitary-ware plants.

The map accompanying this article illustrates this strongly. It is apparent that a heavy construction program would create employment and purchasing power in every section of the country.

Even though only one-half of the supplying industries have thus far been studied, some of them incompletely, the preliminary figures already reveal nearly a million men engaged in manufacturing construction materials, equipment and supplies, or roughly, one out of every ten engaged in manufacture. Payroll figures aggregate 1⅓ billion dollars. The larger and more important materials industries, it is true, are included in these figures, but added figures for the remaining industries will swell these totals considerably.

The density indications on the map may, on first examination, be questioned, for they are at variance with accepted ideas of industrial distribution. Many states considered negligible in the general industrial picture show up heavily

Number of men employed in 1929 in industries manufacturing construction materials, as tabulated on p. 639.



as producers of construction materials. Thus we find Mississippi, with 24,000 employees, Louisiana with 26,000, Oregon 28,000, and Washington with 49,000, riding high above both Massachusetts, which has 14,000 employees, and Missouri with its 17,000. The paradox in this group is attributable to lumber and timber products, in which the South and Northwest predominate.

Alabama combines steel with her lumber production, to rank high as a construction supplier. Connecticut outranks her northern neighbor, Massachusetts, by virtue of her hardware and other metal manufactures. California and Minnesota totals are swelled by lumber production.

The list is headed by Pennsylvania, Illinois, Ohio and New York, each with over 50,000 employed in these industries. Pennsylvania's figure of 100,000 men is attributable in great measure to her steel mills and to a heavy production of cement. We must remember, though, that steel from this state is shipped in semi-finished form to far-off states for fabrication, thus adding to employment in other sections.

And it goes farther than this. We have considered only the manufacturing industries proper. But the production of raw materials goes on in obscure towns far from manufacture and far from construction. It gives life to thousands of people, and the closure of their mines, quarries and sawmills by a slackening of construction is disastrous.

Again, before anything definite can be said about the whole construction industry from the raw-materials stage to the finished product, the study will have to be pursued much farther. The analysis of the manufacturing phase alone will require 48 classifications, and of these only some twenty have so far been completed. After tabulation of this division, the employment and payroll statistics must be determined for the industries that produce raw and semi-finished materials for the manufacturing groups. Involved also is a study of the persons and purchasing power accounted for by the transportation, by rail and highway, of the construction materials in raw and finished condition. Finally, to complete the picture it is necessary to study the dealer organization that lies between producer and contractor and then add the forces engaged in design and supervision and in the actual work of construction.

Construction Supply Industries (Manufacturers only)

Aluminum manufactures.
Asphalted-felt-base floor covering.
Cast-iron pipe.
Cement.
Clay products (other than pottery) and non-clay refractories.
Concrete products.
Doors, shutters, and window sash and frames, metal.
Gas and electric fixtures, lamps, lanterns and reflectors.
Glass.
Hardware, not elsewhere classified.
Iron and steel; steel works and rolling mills.
Lime.
Linoleum.
Lumber and timber products, not elsewhere classified.
Paints and varnishes.
Paving materials, asphalt, tar, crushed slag and mixtures.
Planing-mill products (including general millwork) not made in planing mills connected with sawmills.
Plumbers' supplies, not including pipe or vitreous-china sanitary ware.
Pottery, including porcelain ware.
Roofing, built up and roll, asphalt shingles, roof coatings other than paint.
Sand lime brick.
Steam fittings and steam and hot water heating apparatus.
Structural and ornamental iron and steelwork, not made in plants operated in connection with rolling mills.
Wall paper.
Wall plaster, wall board, insulating board and floor composition.
Window and door screens and weather strip.
Wrought pipe, welded and heavy riveted, not made in plants operated in connection with rolling mills.

Public Improvements and Land Values

Lawson Purdy

Former President of the Board of Taxes and Assessments of the City of New York

PUBLIC-WORKS CONSTRUCTION aids business no only through activating industry. Westchester County by constructing a great parkway system added hundreds of millions to the value of private property. Mr. Purdy cites other facts showing that public improvements not only give service but at the same time create new wealth.

THE TAXPAYER'S interest in public works is mainly a matter of dollars and cents. What does he receive in return for the cost of a given public improvement? Sometimes the service value of the improvement is sufficiently remote, so far as he is concerned, to make the improvement seem nothing more than expense. Does it produce a return other than service? The taxpayer is justified in asking the question, since he pays the cost of the improvements.

The history of taxation supports the author in asserting that useful, well-planned public improvements return to the taxpayer enhanced value of his land. I have in mind the time since my service with New York began, a period during which the city's investment in public works more than doubled. Real estate values grew from about five billions to more than eighteen billions of dollars during this period; or, deducting the value of buildings and other private improvements, the land value alone more than double, from about four billions to nine billions. These figures reflect the gain in the productive power of the community, a quantity that depends less on population that on the tools which that population uses—consisting largely of its public facilities.

Under an ideal system of benefit assessment the enhanced value of land might be applied to paying the cost of improvements. In this case taxes would be increased only as the value increased. The property owner then would have no difficulty in recognizing the justification of the improvements. Under the financing system commonly used, these facts do not appear as clearly as they might, and therefore public improvements are often looked on as a burden to the taxpayer.

It is fair to ask whether any taxpayer or owner of real estate would be willing to give up the water service, the paved streets or the schools and hospitals that now serve his community. On the score of the service these render alone, he would not give them up; but quite apart from service he might properly ask what his property would be worth if these improvements were wiped out.

This concept of "property value"

needs to be understood clearly in such a discussion as the present. The matter may be approached in this way: When we think of an effect on value—that is, an increase or decrease in the value of property—we do not mean the value of the building that stands on the property; the building is worth what it cost or less, depending on the material advantages of the site and the adaptation of the structure to the site. Land and building together are worth what they can produce. This amount may be augmented or diminished, but the productive power at any stage is inseparable from the location or site itself.

We conclude two things: first, that land value depends on *the productive power of the community;* and second, that when we speak of the influence of public improvements on property value we are really concerned *with their influence on land value.*

The influence of population

When public improvements increase the productive power of the community, they increase the value of the land; otherwise not. It is by this definition that the meaning of public works with respect to property value must be judged. Those public works are valuable which make life more worth living, more efficient and desirable. Such works benefit the individual property owner as well as the community.

So long as population grows or even moves, we shall have new streets, we shall erect public buildings and otherwise add to the facilities that minister to general convenience and productive efficiency. If we plan these new works well, we shall in like measure add value to land.

There we meet the important question: Is land value proportional to population? The business potentialities of a large community are obviously greater than those of a small one, and it follows that population is a factor in determining land value. But it is only one of several factors, and by no means the most important one.

Some years ago I had occasion to compare land values in different regions in studying this question, and for the purpose I took three regions unlike in climate, soil and people. Mississippi proved to have a land value of $430 per capita, New Jersey of $1,700, and Nevada of $3,500. The small population of Nevada, as against the large population of New Jersey, evidently did not keep its land value down; and Mississippi, with larger area than New Jersey's and with total population not much less, had only one-fourth as great a land value per capita. Other factors than population appear to dominate.

It is interesting to observe that, at the time these figures were compiled, the current per-capita expenditures of the three states for highways were about in the same order as the land values, namely, $0.61 for Mississippi, $1.59 for New Jersey and $6.95 for Nevada. And the same order appeared also in per-capita school expenditures: Mississippi $2.75, New Jersey $5.03 and Nevada $10.13.

Quite similar relations were found to exist between three counties within one state. The land values per capita were respectively $1,000, $1,000 and $3,000. Investments in parks and school properties were $15, $30 and $90 per capita. In two cities of the same size, but in different states, land values were $1,100 and $3,700 per capita, and investments in school properties were $29 and $134. Coming to still narrower geographical range, two villages of about equal population, suburbs of the same city, had land values of $960 and $2,800 per capita, and highway expenditures of $3.80 and $7.70 per capita.

Facts such as these, which might readily be multiplied in any desired degree, suggest that population is a quite subordinate factor in land value, and that such influences as industrial or commercial advantages of location, climate, natural resources and character of people are predominant. In any event, location (site value) is an important factor, as may be gathered from the fact that land values in Mississippi are only 15 to 20 per cent of those in Rhode Island —the latter located in highly favorable geographic position with respect to both domestic and foreign markets.

How improvements increase land value

Clear indication appeared in the figures cited above that there is a relation between expenditures for public improvements and value of land. Fuller analysis of this relation is difficult because of the number of factors that bear on land value. A classic example is therefore worth citing in spite of the fact that the figures are of 25 years ago.

When the first New York subway line was built in 1900 to 1904, it caused a large increase in land value along the route. The increase was a net benefit to the owners of the property, as the line was built by private capital in return for the operating concession. An accurate determination of the increase was made by a committee of the City Club, by comparing the values of the vacant land before the line was built and after it was placed in service (1900 and 1907) and deducting from the gross increase the "normal increase," taken as equal to the increase of value that had occurred in an equal number of years preceding (1893-1900). The following facts were found:

In the section from 79th to110th Sts., between Central Park and North River, the gross increase (45 per cent) about equaled the normal rise; a similar relation was found along the Lenox Ave. branch south of the Harlem River. Both these districts already had rapid-transit service through elevated railway lines. From 135th St. to Spuyten Duyvil Creek on the Broadway branch, the gross increase was $69,300,000, the normal increase $20,100,000; the net increase due to the subway line therefore was $49,200,000. Along the Bronx branch north of the Harlem River, the gross increase was $44,800,000, the normal increase $13,500,000, and the net increase therefore $31,300,000. Thus the total net increase in land value in the two regions considered was about $80,000,000, while the entire cost of the subway from the Battery north was only $43,000,000.

Here, then, the improvement created additional land value amounting to almost twice the cost of the improvement. It is probable that similar gains to the private owner result from other essential improvements, though only rarely would they reach so large a ratio.

The gain in the case of the subway, moreover, should properly be discounted by a considerable item, as the improved properties fronting directly on the line suffered a large loss in earning power during construction of the line, because the open-cut method of construction was used on most of the length, a matter that involved serious interference with business during the four or five years of construction. While this loss is not chargeable to the subway project as such, it means that the true gain in property value is less than that computed, by the amount lost to the property during construction.

A conclusion and a caution

Generalizing from this single case and making use of well-known facts about public betterments, it may be said that community improvements return to the public not only their service value (which presumably is at least equal to the cost, if the decision to build the project was prudently made) but also a further gain in the form of increased land value. While definite proof is perhaps impossible, the writer believes that in the long run this gain in value is fully equal to the cost of public improvements, though single projects may show smaller or greater gains.

In considering this value increment as bearing on programs of public-works construction, officials and engineers should be on their guard against being misled by the activities of the real-estate developer. A great deal of his work in staking out streets, providing or demanding improvements and attaching false values to the land, is injurious to the interests of the existing community. Especially should there be caution in relying on claims of value or even sale prices in such developments as justifying proposed improvements. The history of every city contains ample record of the false expectations, wasted public investment and uneconomical extension of public services arising from over-sanguine real-estate development.

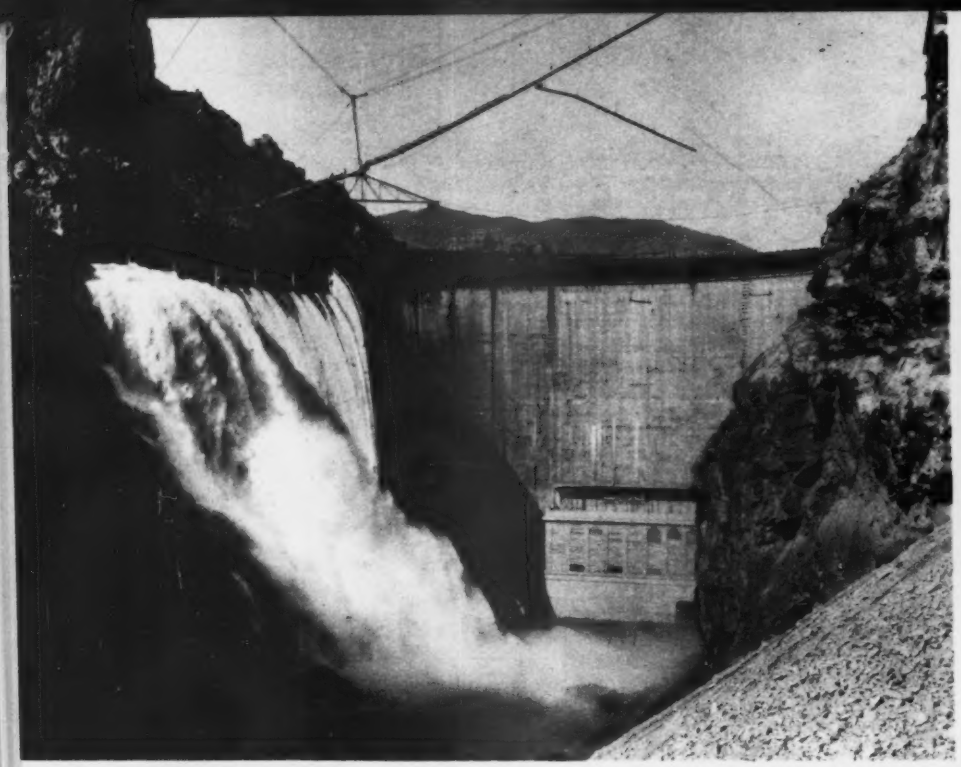
PUBLIC WORKS

built to serve the vital needs of nation, state and local community.

GEORGE WASHINGTON BRIDGE across the Hudson River at New York, a notable suspension structure that is proving self-liquidating even in a depression.

WASHBURN PARK WATER TOWER *(right)* in Minneapolis, Minn., assures good service for a district remote from the main pressure distribution system.

CONSTRUCTING THE SOUTHWEST OUTFALL SEWER, which will connect Louisville's new $17,000,000 sewer system with the Ohio River.

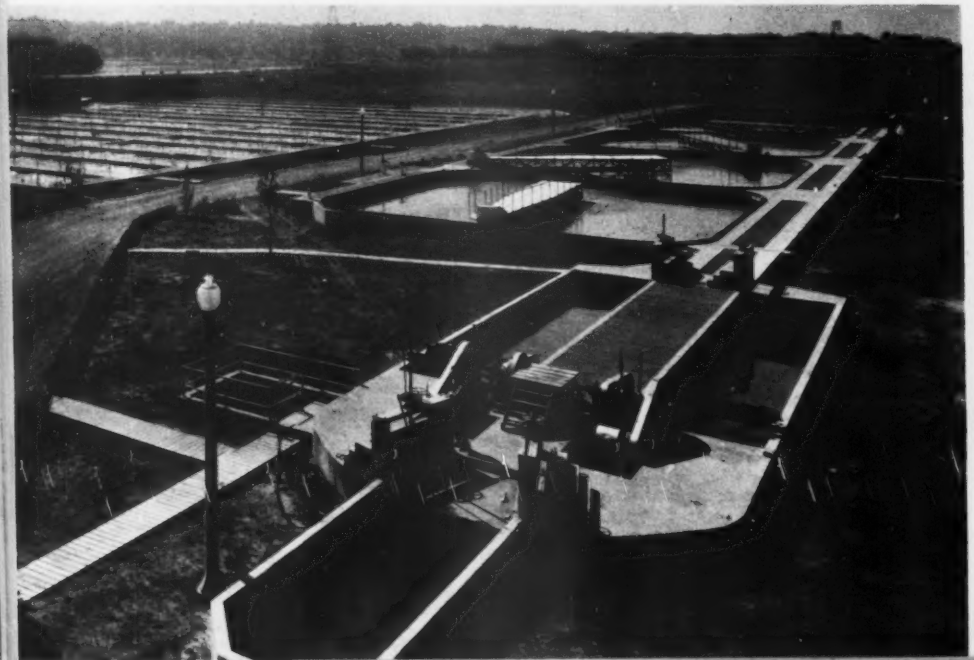


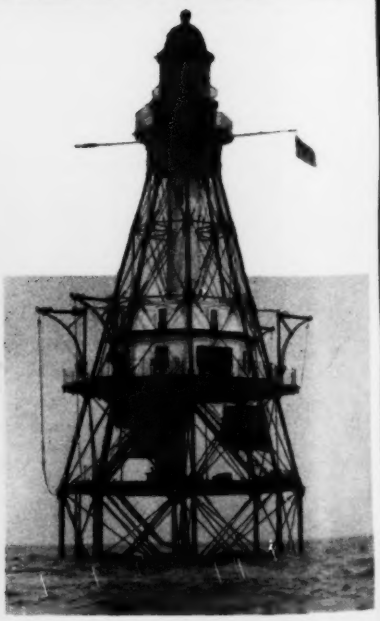
HORSE MESA DAM in Arizona, built to serve the Salt River Valley Water Users' Association.

CABLE-STRINGING on the Mid-Hudson suspension bridge at Poughkeepsie, N. Y., which was built and is operated as a toll structure by the state department of public works.

RARITAN RIVER BRIDGE, built by the New Jersey state highway department in 1930, has taken some 25,000 vehicles daily off the congested streets of the city of New Brunswick.

SEWAGE-DISPOSAL PLANT *(below)* of activated-sludge type at Peoria, Ill., is typical of modern facilities suitable for both domestic and industrial wastes.





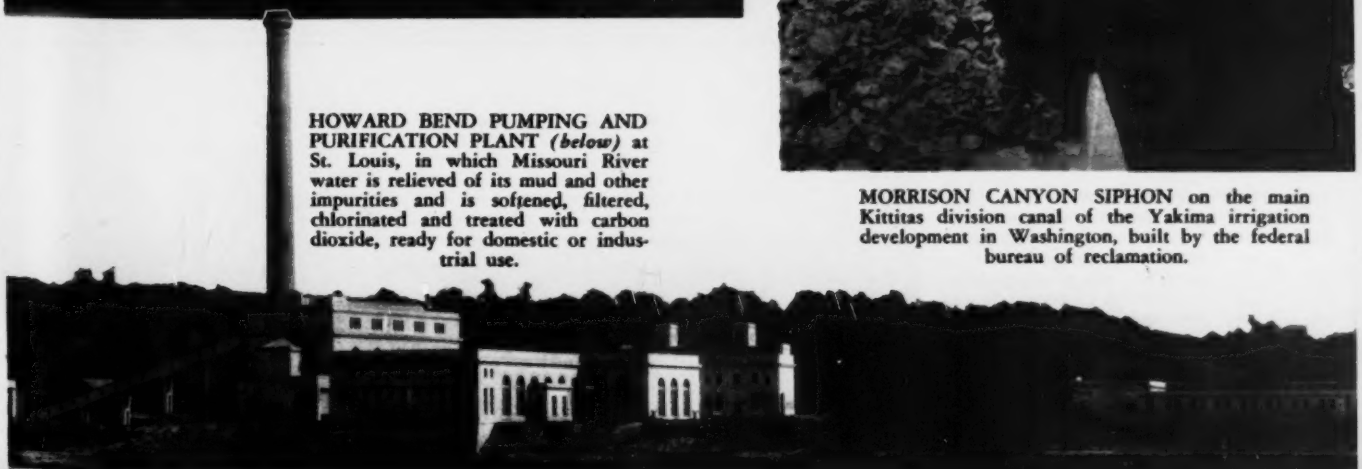
LIGHTHOUSE STRUCTURES of various types are necessary and normal items of expense in the federal budget.

MECHANIZED CONCRETE ROAD construction is not devoid of labor requirements, as this view of a typical job shows.

MORRISON CANYON SIPHON on the main Kittitas division canal of the Yakima irrigation development in Washington, built by the federal bureau of reclamation.

BITUMINOUS ROADS *(below)*, such as this one, form a substantial percentage of the serviceable road system of the nation.

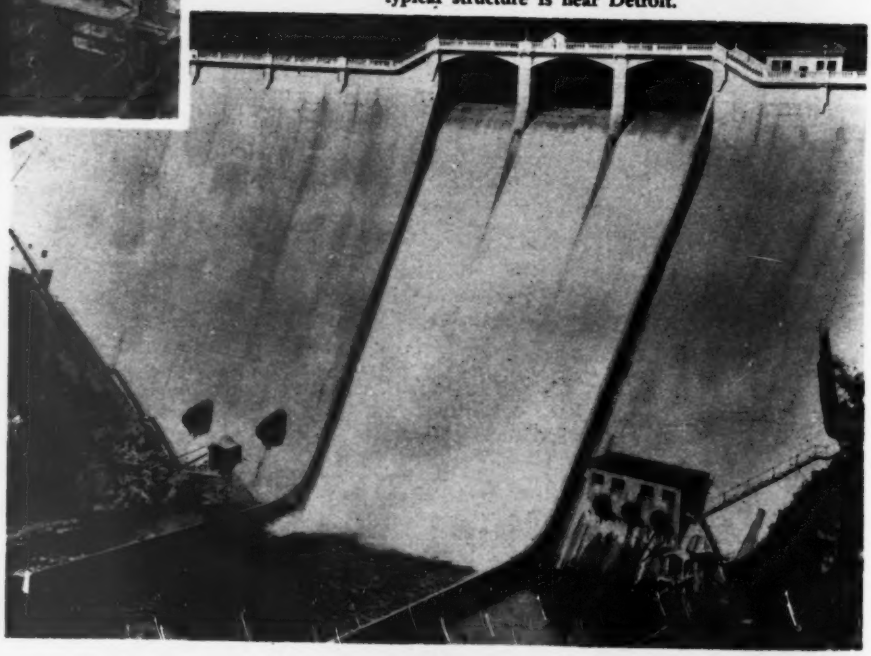
HOWARD BEND PUMPING AND PURIFICATION PLANT *(below)* at St. Louis, in which Missouri River water is relieved of its mud and other impurities and is softened, filtered, chlorinated and treated with carbon dioxide, ready for domestic or industrial use.



SINKING articulated concrete revetment mats for bank stabilization in the Mississippi River flood-control program.

POURING DECK COLUMNS for the George Westinghouse concrete arch bridge over Turtle Creek Valley at East Pittsburgh, Pa. This structure saves Lincoln Highway travelers a congested and time-consuming trip through the industrial district below.

SEPARATION of railway and highway grades comprises one of the most fruitful and necessary types of public works. This typical structure is near Detroit.



BULL RUN DAM at Portland, Ore., *(right)*, forms a reservoir that is the source of supply for 400,000 water users and regulates floods on the river as well. The dam is fitted for the production of hydro-electric power, should this ever become desirable.

FINANCING AND PAYING FOR PUBLIC WORKS

IMPROVEMENT BONDS—*Lionel D. Edie*
EQUITABLE TAXATION—*Carl Shoup*
SERVICE CHARGES—*John P. Hallihan*

WHERE does the money come from? What do bonds and taxes mean with respect to public works? • Most public works are financed through borrowed money. Dr. Edie tells where this money is obtained and indicates that if bonds for improvements are to be sound they must conform to definite standards. • Later, the money to pay off the bonds must come from current revenue. How is that revenue derived? • Well-informed writers discuss the principles and problems of distributing the tax burden and of raising revenue by direct service charges.

Public-Works Finance in Normal and Emergency Times

Lionel D. Edie

Investment Counselor; President, Capital Research Co.; Former Professor of Public Finance, University of Chicago.

IN 1914, the state and local public debt of the United States was about $4,900,000,000; today it is nearly $19,500,000,000. Most of this sharp increase represents financing of capital outlays and affords a background of experience in financing such undertakings today.

The principle of borrowing for the purpose of making durable improvements is so familiar in private corporation practice that no one stops to question its validity. True, the principle has frequently been abused, as the top-heavy capitalizations of many railroads and other corporations testify. But the fact that abuses have crept in does not destroy the soundness of borrowing for capital outlays on the part of wise and conservative corporation executives.

Although the same principle is sound as applied to public finance, nevertheless it has to be applied with due regard for one important distinction. The private corporation plans to pay off bonds out of earnings accumulated during the life of the property. But the municipality, not being able to depend upon earnings, except in case of toll or service-revenue works, has to pay off bonds out of tax revenues accumulated during the life of the property. In the one case, ability to earn is the test of sound borrowing power; in the other case, ability to tax and ability of the citizen to pay taxes.

During the boom days of the twenties, undoubtedly, many municipalities borrowed to excess. From 1922 to 1929, municipal debt in this country was increasing on an average at the rate of more than a billion dollars per annum. Debt retirement was too slow, with the result that debt-service charges are still mounting. In 1933 these charges (state and local) will amount to more than $1,500,000,000, or more than 20 per cent of all taxes collected by such units of government.

Under a deflated price level and under extreme depression this load becomes distressing. Thus, by the end of 1932, probably 1,200 municipal issues were in default and many others were on the edge.

Under boom conditions, much borrowing represented municipal extravagance. In many cases, politicians curried public favor by borrowing to finance community frills and deferring the full tax load for service charges to future years. Often bonds were issued for terms so long that they exceeded the life of the capital improvements. It will take many years to make readjustments of the unwise and uneconomical expenditures of many municipalities.

But to dwell upon these excesses unduly would give a wholly false impression. The sound and constructive projects of the past decade outnumber the other types.

The tests of soundness are too numerous to be itemized in detail here, but a few deserve to be mentioned. The total amount of borrowing for all purposes should bear a reasonable ratio to population, to community income and to taxpaying ability. The maturities of a municipality should be so arranged that all issues do not fall due at one time. The length of the bond should not exceed the life of the improvement. Amortization should begin in the first year of the issue so that the taxpayer is immediately conscious of the burden which he is to bear in retiring the debt.

Moreover, even where these principles are fully adhered to, a governmental unit is unwise to finance all of its capital requirements by borrowing. A substantial amount of such requirements should be taken care of by a pay-as-you-go policy. This policy is well illustrated in the financing of highways by gasoline taxes. In part, the pay-as-you-go policy should be followed in normal times far enough to exert a sobering influence and to encourage prudence and economy.

But to require all projects to be

financed in this cash manner would be unnecessary and unsound. Communities would be deprived of the privileges of modern sewage disposal, modern highways and modern schools until long after pressing needs had arisen. Not only that, but taxpayers today would be shouldering an immediate burden which in equity should be spread over future taxpayers as well. Future taxpayers will enjoy the benefits of capital improvements and should share in the task of paying for them.

When municipal bonds are issued under the proper safeguards and limitations, as indicated above, such obligations normally attract the savings of prudent investors. *Good municipal bonds were a favorite investment until deflation destroyed taxpaying power, and they will undoubtedly return to favor again* under less abnormal conditons.

As of 1932, institutional investors are estimated to have owned municipal bonds in approximately the following amounts:

Life insurance companies	$ 727,000,000
State and national banks	1,292,000,000
Loan and trust companies	400,000,000
Savings banks	1,110,000,000
Total	$3,529,000,000

Even this large sum represents less than 20 per cent of the total outstanding. The bulk of such bonds have hitherto been bought by individuals, and for a particular reason, namely, the tax-exempt feature which has applied to so large a part of the issues. This tax-exempt feature has probably made it unduly easy to float municipals in the past and has had some responsibilty for borrowing excesses.

Wide distribution of bonds

The two features of institutional buying and of buying for tax-exempt features have had a very interesting effect upon the geographical distribution of ownership. The big institutions and the payers of heavy income taxes concentrate in the large cities, particularly in the northeastern part of the United States. Thus a municipality in Colorado may float a bond issue and have the bulk of it lodge in the hands of investors on the Atlantic seaboard.

This distribution is harmless; it is by no means necessary or desirable that the local community be the sole or even the main buyer of its own bonds. Nevertheless, this peculiar geographical distribution raises an important problem when a federal public-works program is considered today. If Colorado issues a municipal bond and New York buys it, the taxes to liquidate it are paid by Colorado. But if a federal bond issue raises money which is spent on a project in Colorado, what is the distribution? Colorado gets the major benefit of the improvement, but New York (and the large cities generally) pays the bulk of federal income taxes. The eastern cities buy the bulk of the federal bonds and pay the bulk of the federal taxes, but the benefit of the federal public works goes to the interior.

In this many people see a gross injustice to the eastern cities and a cogent argument against a federal public-works program. But the case is not nearly as forceful as it at first seems, for the prime motive back of the federal works is to revive business for everybody. And if business revives, the eastern cities will be more prosperous and will find the annual service charge on the federal bond issue a cheap price to pay for the restoration of better times.

As a matter of fact, if we are to have a public-works program at all today, we must finance it by federal action for the reason that the municipal bond market is in a state of temporary inability to absorb new issues on any considerable scale. The causes of this breakdown of the municipal market have already been indicated, namely, borrowing to excess in particular instances and destruction of taxpaying ability by deflation and depression. If the Administration is able to raise the price level and to effect a restoration of business activity, the second cause will be corrected and a municipal bond market for sound issues will again come into existence. Eventually we shall in all likelihood return to a condition in which the great bulk of public improvements is financed by the municipality.

Public construction is now advocated with three major purposes in mind. The first purpose is to provide activity for the construction industries themselves, to relieve them of depression, and to restore a measure of prosperity in that whole group of industries supplying materials to the construction industry. The second purpose is of social character: to provide re-employment for labor and thereby to lessen the burden of unemployment. Plausible estimates have been made that a three-billion-dollar public-works program in the U. S. today might put three million men back to work. This does not take into account the possibilities of putting additional groups back to work in case new construction served to crank the motor of general business with the result that general business thereafter was able to move forward on its own power.

To most people actively engaged in the construction industries these two purposes may seem to be the paramount considerations. However, the present proposal for public works embraces a purpose which goes very definitely beyond these old and familiar purposes. The very fact that this additional purpose is new and different leads most people to be reluctant to admit its importance. What is this new purpose?

It is to use the public-works program as an instrument for making a credit expansion policy effective.

The public-works program is, therefore, subordinated to a monetary program. It has to be analyzed in the light of the powers granted to the President by the inflation bill. The first power granted is to arrange with the Federal Reserve authorities for purchases of government securities. The final and immediate result of such purchases has, under certain conditions in the past, been to pile up idle funds in the vaults of the banks. The problem has been how to get these funds out into the hands of ready and willing buyers of merchandise.

Sponsors of the public-works program believe that by letting loose a flood of new contracts and new orders for all kinds of materials and supplies entering into construction work and by disbursing payrolls on a wide variety of projects, new funds can be put into active trade circulation. They further believe that this process will stimulate a rising tendency in the domestic commodity price level and radiate circles of additional demand and employment.

Effect on federal budget

Such public-works financing should not and need not interfere with the broad concept of a balanced budget. The new financing must be so managed that it does not impair the maintenance of the credit of the United States government. To this end the minimum requirement would seem to be that interest on new borrowings to finance public works must be included in the ordinary budget. This means adding in the neighborhood of $100,000,000 to the ordinary budget.

Some authorities would argue that amortization should be provided for by setting up a sinking fund under the ordinary budget. This argument is certainly sound as applied to normal conditions. However, it must be remembered that the ordinary budget today does not contain provision for sinking fund on the outstanding federal debt. The sinking fund, in other words, is treated as an emergency matter and, if this is valid with respect to the outstanding debt, it may be argued that it is just as valid with respect to new debt created for a public-works program.

As soon as business picks up, the federal revenues may be expected to increase, and at such a stage amortization should undoubtedly be provided for.

A public-works program means more government debt any way one looks at it. Moreover, more debt eventually means more taxes any way one looks at it. Whether the taxes should be made a little heavier or a little lighter right now and whether they should be spread over 10 years or 20 years are after all relatively minor questions.

The main question is whether credit expansion is to be made effective through a broad public-works program. If it is effective, the added burden of federal debt and taxes will be relatively easy to meet on a higher level of business and commodity prices.

A further financing problem of major importance is: After the money has been raised how can it be put to work on the

individual projects? Here time is the essence of the case. The objective is to produce a real stimulus to employment and trade at large within a period of six to twelve months. In the past, public-works programs have involved interminable delays. Red tape and procrastination have surrounded the execution of projects. If the new program is to be effective it must operate in such manner as to cut through all these usual obstacles and to function promptly.

This being the case it is desirable to handle a substantial proportion of the new expenditures through a special and separate federal administrator of public works. If he can be given power to make direct federal expenditures on those types of projects which are not confined to purely local municipal use, but which have a general public use, he can cut short the usual delays in execution of public-works activity.

An additional financing problem will arise in connection with what may be called secondary financing. This has to do with bank loans. As soon as contracts are let, contractors immediately put in orders for steel, cement and other building materials and supplies. They go to the banks and apply for loans to supply working capital. Will the banks grant such loans?

The probability is that they will. In most cases the security for such loans would be of a satisfactory type. Definite orders would be in hand and ultimate payment would be reasonably certain because the Government would be the ultimate source of revenue. Bank loans for such a purpose would not be capital loans and would be loans of a self-liquidating character. Banks would be under some pressure to be liberal in expanding accommodation because of excess funds which they would be anxious to put to work.

In summary

By and large, the technical aspects of financing public works are submerged by the much larger social objective which underlies the whole conception. Where an emergency situation exists, public works are merely a tool or instrument for meeting this emergency situation. They are not an end in themselves, but are a means to the end of making credit expansion effective and restoring employment and business activity. To lose sight of this primary objective is to miss the whole point.

Assuming that the broad objective is sound, and assuming further that social pressure makes it important to overcome the depression at this stage, the great task is to put the program into operation as rapidly as possible and to strive in every way to make its general economic influence felt promptly.

The public-works program at this time is an experimental approach to recovery, but it is an experiment which has a reasonable probability of success. The sooner the whole machinery is set up in motion the better. The program can be financed without undermining the credit of the government and, if it is effective, the ultimate tax burden will not be oppressive.

Distributing Costs Equitably Through Taxation

Carl Shoup

School of Business Administration, Columbia University, New York, N. Y.

A CHORUS OF *depressed* railroad presidents and realty operators cries out against real-estate taxation. Tax strikes have closed schools, dried up public activities and stopped not only construction but even maintenance. Dr. Shoup in discussing equitable taxation for public improvements finds that the real-property tax is not unfair.

TAXES as a whole are payments made in consideration of services rendered. The organization performing the services is called a government and is contrasted with "private" organizations, which likewise render services in consideration of payment. *The percentage of our income which is paid out in taxes depends upon the extent to which we purchase services from a governmental rather than a private organization.*

Services that we are now thoroughly accustomed to receiving from the government, such as elementary education and the use of trunk-line highways, were formerly very largely purchased from private organizations. Services that we now purchase almost entirely from private organizations, such as medical care, might conceivably be purchased from the government, and if that were to happen, new taxes would merely replace a certain amount of private expenditures. Thus tax payments as a whole represent the purchase price for certain kinds of services and commodities which we—or those to whom we entrust political power—decide should be obtained through governmental channels.

The individual taxpayer may feel inclined to protest at this point. Surely there are some vital differences between paying taxes and paying for a suit of clothes! True, there are. The parallel drawn above was between taxes as a whole and "private" purchases as a whole. When the individual taxpayer is considered, it is found that most of his tax payments differ in at least two highly significant respects from the payments he makes for a suit of clothes.

First, the individual often has to pay the government for something he does not want (the pacifist, for instance, pays a tax, part of which goes to defray the cost of a battleship), whereas he need not buy a new suit of clothes merely because his neighbors or his legislators think he ought to do so.

Another difference is that when the taxpayer receives a service from the government it is often difficult, if not impossible, to determine how much expense the government has undergone in furnishing the service to any given individual, as distinct from the whole group of taxpayers. It can of course be determined how much it costs the federal government to supply all the people of the country with the protection furnished by a battleship, but it is impossible to say how much of this cost is "caused" by any individual citizen. Another method, perhaps one based on rela-

tive ability to pay, must be employed. Certain government services, such as highway building and maintenance, can be "sold" to the taxpayer very largely on the basis of the cost that he as an individual user has caused. The gasoline tax and motor-vehicle registration taxes are used for this purpose, and hence are often spoken of as "direct benefit" taxes. Most governmental expenditures, however, are not incurred for this type of service. This can be demonstrated by noting the following data on tax collections.

Leading tax facts

There are three kinds of governmental units that furnish the people of the United States with services: federal, state and local. The total tax receipts of these units (to the nearest billion) are now about ten billion dollars a year, of which the federal government receives three billion, the state governments two billion, and the local governments five billion. The only major revenue item that the federal government collects on a "direct benefit" basis—that is, where the individual user of the service pays on somewhat the same basis as a purchaser of a suit of clothes—is the postal revenue, which is not included in the above figures on tax revenue. Even here the allocation is not strictly carried out, for the postal service as a whole is operated at a loss, and certain classes of mail more than pay their way, while others are far from doing so. The only major item collected by the state governments on this benefit basis is motor-vehicle taxes (on gasoline and registration). The localities occasionally levy, or share in, these motor-vehicle taxes, and in addition they collect a considerable sum from real-estate owners by so-called "special assessments"—a sewer, for instance, may be laid and the cost thereof prorated among the users.

Turning to certain items not usually grouped under taxes, one finds that most localities furnish water and charge the user thereof in proportion to his use, and in some instances the local government furnishes electricity, gas, and certain other goods or services on the same basis.

Of the ten billions of tax revenue noted above, however, not much more than one billion is collected on the basis of "benefit" or "cost-of-service-to-the-individual," with the exception of part of the local property tax, which is to be discussed later. By far the bulk of the tax burden is distributed on some basis other than direct benefit.

Where taxes come from

The distribution of the nine billion dollars noted above is very widespread. Probably no one, save criminals, lunatics and other wards of the government, escapes bearing some part of this cost either directly or indirectly. Certainly there is no large tax-free class. In terms of kinds of taxes levied, most of the nine billion—about five billion, or well over 50 per cent—comes from the property tax, collected by state and local governments. More than one billion (a few years ago more than two billion) comes from income taxes on corporations and individuals, by far the larger part of this being collected by the federal government. Tobacco taxes (largely federal) and customs duties (entirely federal) each supply not far from half a billion, although the customs revenue has recently dropped somewhat below that level. Various license and permit charges levied by state and local governments total another half billion, although some of these are not, strictly speaking, taxes. Roughly a quarter of a billion comes from the estate and inheritance taxes (largely state). The rest of the nine billions, i.e., somewhat over one billion, comes from miscellaneous tax sources, no one of which is of relatively great importance, although the numerous excise or consumption taxes levied by the federal government last year appear to be yielding at the rate of one-fourth to one-half billion dollars a year. There are some two dozen taxes within this group, but almost half the revenue is coming from the 1-c. gasoline tax.

The figures above have purposely been made approximate rather than exact. Complete data for all the items are not available, and more detail might obscure the general outline that has been traced. The essentials of the picture are that the nine billion dollars come very largely from the property tax, and to a considerably less extent from taxes on a few widely used domestic commodities (notably tobacco), from import duties and from income taxes.

Real-estate tax analyzed

The property tax is usually levied as a certain per cent on the capital value of the property. Thus if the taxable value of a house and lot is placed at $10,000, and if the tax rate is 2 per cent, the owner of the property must pay $200 a year if he does not wish to see it eventually seized by the government and sold to satisfy overdue taxes. This tax, used exclusively by the state and local governments, has a long history in the United States. After an early period when each type of taxable property was specifically mentioned in the law, the states developed general-property-tax laws, which simply stated that all property should be taxed unless exempt for some special reason, as is usually the case, for instance, with property owned by governmental units or used for religious, charitable or educational purposes. Strictly speaking, a general-property tax would therefore require a taxpayer to pay each year at a certain rate on the true value of all his property, whether real property, tangible personal property (stock in trade, personal effects such as clothing and furniture, etc.) or intangible personal property (rights to income as exemplified by shares of stock, bonds, etc.). In practice it has been found impracticable to do this. Taxpayers have concealed their easily hidden intangible property, thus necessitating a still higher tax rate if the needed amount of total revenue is to be obtained from the other property, particularly real estate, which cannot be hidden. The higher rate has given still more incentive to hide intangibles, and so the spiral has mounted. The attempted taxation of furniture, clothing, etc., has not been much more effective. The result is that the "general" property tax has become, in effect, largely a real-estate tax.

Superficially, a serious maladjustment of the tax system might appear to have taken place. Half the tax payments or more made directly by one group, owners of real estate? Farmers, homeowners, apartment-house owners, commercial and industrial real-estate owners, subject to this paymnt, while they also share in some of the other billions, raised from the numerically much greater body of wage and salary earners and professional men, many of whom own no real estate? The mere statement of these facts is a challenge to an analysis of our tax system, and it is well that this challenge be considered, for even the brief exposition that can be presented here will indicate how deceptive some of these apparently simple facts can be. The real-estate tax illustrates the operation of several forces that must not be forgotten if an intelligent opinion of the entire system is to be formed.

Paid by beneficiary

First, the "benefit" principle emerges once more. It is well known, for instance, that fire-insurance companies charge higher rates in towns that have poor fire-fighting service than in towns where such service is adequately maintained. The insurance companies rate each town on a "point" system and establish base rates that vary from town to town in accordance with the condition of the water-supply system, the fire department, the fire-alarm system and other conditions affecting the fire hazard. If a town with a poor fire-fighting system decides to spend money in improving the system, one of the direct results will be a lowering of the real-estate owners' insurance costs. When such a direct benefit as this follows from a governmental expenditure, may not the beneficiary be requested to defray at least part of the expenditure? Specifically, may not the money spent on fire protection be raised in part at least from taxes on building owners? Other instances of the same nature could be cited.

Next, the fact that the real-estate owner pays the tax does not always

mean that he bears the burden of the tax. The house renter or apartment-house dweller may give no thought to the real-estate tax paid by his landlord; but there is little doubt that if there had been no real-estate tax, rentals would be appreciably lower than they now are. Before deciding to build, apartment-house owners must count taxes as part of their business costs; if they do not believe that they will be able to rent at a price sufficiently high to cover all costs, including taxes on the building, they will presumably refuse to build. It is possible that they will misjudge the future demand and ultimately will have to rent at or below cost; but even this does not necessarily mean that the tenant is escaping the burden of the tax. No matter how low rentals may be at any one time (the present, for instance) as a result of the large amount of building done in previous years, the essential consideration is that still more buildings would probably have been built had there been no tax on buildings, and hence present rentals might be still lower than they are. In any event, it seems justifiable to assume that over a period of years, particularly in a growing community, the building owner shifts most if not all of the buildings tax to the tenant. Thus even the poorest, non-property-owning wage earner carries a part of this tax burden. The tax on land, as distinct from that on buildings, presents a different picture. It is probably not shifted to the tenant, owing to the fact that there is no recurring necessity to "build" land.

Is the property tax unfair?

Finally the real-estate tax illustrates another important factor—tax "capitalization." If the rate of tax on land is increased, the net annual return to the owner of the land decreases because of the increased tax he must pay (the land tax, it will be recalled, is presumably not shifted to tenants). If the net return decreases, the capital value of the land decreases. Any one who buys the land after the tax increase has become known is no worse off than he would have been had there been no tax increase. If there had been no tax increase, he would have had to pay more for the land. To the subsequent purchaser it is therefore a matter of indifference whether the tax has in the past been increased or not. Much land in this country is today in the hands of such subsequent purchasers—people who have bought after, not before, the extraordinary increase in land tax burden that has occurred in the past few decades. To reduce their land taxes now would be to give them an unexpected and presumably undeserved bonus. The injustice, if any, was done once and for all to those who had bought the land some time before it became clear that tax rates would go up. The whole future series of increased tax payments was "capitalized" at once in a decrease (or smaller increase) in the value of their holdings. This factor of tax capitalization has many ramifications; it may for a period of time apply to buildings taxes as well as land taxes; and often it does not operate as smoothly as the above statements might indicate. Whatever modifications appear in practice, it is clear that this factor is important enough to warrant careful consderation when one asks whether the present tax is at an "unjustly" high level.

Income and sales taxes

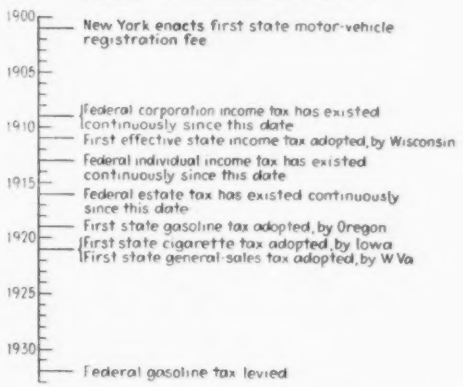
The income tax, unlike the buildings tax, is probably not shifted. The one who pays the money to the government is the one who bears the burden, with certain exceptions that cannot be outlined here. This is so even if the income tax is levied on a corporation or other business firm. There is no substantial foundation for the apparently widespread belief that income taxes on a business are in general passed on to consumers in higher prices. The firm paying income taxes is usually in competition with firms that pay little or no income taxes, because they are operating at a loss or with a meager profit. If two firms are in competition, and if one is taxed and the other is not, it is *prima facie* impossible for the taxed firm to increase its prices in order to pass on the tax.

The various gross receipts or sales or consumption taxes collected from business firms are, on the other hand, usually passed on to consumers, at least in part, as in the case of the cigarette tax cited above. Every firm in the business must pay the tax; in the long run the firms must cover their costs or go out of business; and the selling price must be high enough to cover the tax as well as other costs. The income tax, on the contrary, is not strictly a "cost" in this sense. Indeed, it does not become due unless almost all essential costs have been met.

Most taxes are not benefit taxes

A general view of the tax system may now be taken in the light of the considerations noted above. Of the ten billion dollars of tax revenue, about one billion (chiefly motor-vehicle taxes and "special assessments") plus a large share of the five billion property tax, appear to be "benefit taxes"—taxes levied because the recipient of governmental services causes a certain cost to the government, a cost that can be directly allocated to him as an individual, and which he is asked to defray. Another considerable part of the five billions has long since been "capitalized," and relief to those who were really injured thereby cannot, in many instances, be given by lowering the tax now. Still another part of the five billion is not affected either by the benefit or by the capitalization considerations. Of the other four billions of tax revenue, somewhat less than 1½ billions comes from the income and estate or inheritance taxes—levies which, through a system of progressive rates, allowances for family situation and other details, can be made to fit rather closely to current ideals of "ability to pay." The remaining two billion comes largely from such items as customs duties, consumption taxes, etc., which are for the most part passed on to consumers, who are thereby taxed on the expenditure they make rather than the income they receive. Such consumption taxes are of course relatively more burdensome to the poor than to the rich, for the poor spend most of their income, whereas a large part of the wealthy man's income can be, and is, easily saved, or at least not spent on the taxed articles (and hence escapes consumption taxes to that extent).

Some significant dates in the recent history of taxation in America.


1900
New York enacts first state motor-vehicle registration fee
1905
Federal corporation income tax has existed continuously since this date
1910
First effective state income tax adopted, by Wisconsin
Federal individual income tax has existed continuously since this date
1915
Federal estate tax has existed continuously since this date
First state gasoline tax adopted, by Oregon
1920
First state cigarette tax adopted, by Iowa
First state general-sales tax adopted, by W Va
1925
1930
Federal gasoline tax levied

What, then, are some of the problems that every citizen faces in attempting to pass judgment on the existing tax system and on the constant stream of proposals to alter it? The following group of issues is not all-inclusive, but at least it indicates some of the directions in which our thought must turn.

Questions for the taxpayer

How far should the direct-benefit principle be followed? It is at present applied to some extent in connection with certain urban improvements such as street paving and certain non-city improvements such as highways. On the other hand, educational services are not charged for on this basis, although costs could be fairly readily allocated to the individual. It is felt that education is of such paramount public importance that it should not be restricted to those who are able, at the moment, to pay

for it. Many public works, toll bridges for example, are paid for largely on the direct-benefit basis; others, such as court houses, are not. The individual citizen will have to ponder over this general problem whenever he is faced with a proposal to increase governmental expenditures or to change the existing distribution of burden.

For those expenses not defrayed under some form of the benefit principle, what principle shall be used in distributing the burden over the group as a whole? Does the present combination of taxes represent a desirable distribution? Is the present amount of consumption taxes (resting primarily on the poor) relatively too small or too large compared to the amount raised by income taxes (resting primarily on the well-to-do)? Can the income tax be revised so that it will reach more of the poor, thus allowing repeal of some of the consumption taxes? How does the real-estate tax fit into this picture?

Does our present division of governmental structure between federal, state and local units hinder a desirable redistribution of the burden? For example, the smaller the unit the more difficult it is, usually, to levy an income tax, whereas the small unit can readily collect a real-estate tax. If we wish to alter the relative sums raised from various types of taxes and also to avoid a haphazard distribution of the burden that comes when the various taxing "layers" work more or less independently of one another, attention must be given to the federal-state-local relationships.

The problem not insoluble

How much weight should be given to administrative difficulties? Certain phases of the income tax, for instance, show that a fair distribution of the burden can be obtained only at the expense of complexity. To how much labor and expense are the government and the taxpayer willing to go in the interests of equity? A community with a well-developed public morality need not fear complexity in taxation as much as a community where taxpayers regard taxation as a game where the loser pays.

Many more questions could be asked. The reader may be tempted to feel that the problem is so complex as to be insoluble. Perfection would never be obtained, even if we could all agree on what is desirable. Nevertheless, it does not seem too much to expect that, with the aid of common sense and careful attention to some of the less obvious workings of the tax system, we can avoid some of the blind alleys and rough roads along which the nation as a whole does not wish to travel in its taxing machine.

The present writer is inclined to believe in the light of the considerations mentioned above, first, that aside from the question of import duties and an extension of the field of income taxation no wholesale revision of the present tax system is in order, particularly if such revision implies the substitution of consumption levies in place of a large part of the real-estate tax; second, that much progress can and should be made in the reallocation of functions and of tax sources among the various governing units.

Financing Public Improvements Through Service Revenues

J. P. Hallihan

Chief Engineer, Rapid Transit Commission, Detroit, Mich.

MAKING THE USER of public facilities pay for the service he receives is often difficult. Tolls and other service revenues have been prominent since the "self-liquidating" proviso paralyzed last year's emergency construction act. But tolls have large possibilities, which Major Hallihan has studied thoroughly in his work on the Michigan Committee for Trade Recovery.

THE AVERAGE citizen pays very little attention to the mechanics of government. He regards public officers with distrust and considers them overpaid for their services, but he accepts his tax bill as a lump sum without investigation because of an old tradition that study of public affairs is a waste of time. He is consequently unaware of the faithful and continuous effort required to maintain the services he requires and to provide in advance for their expansion in time to meet the increased demands of the community; nor is he aware that this machinery, operating generally under much more onerous conditions than if privately controlled, must function irrespective of changes in the political complexion of the administration.

It is only in times of adversity that he can be brought to consider the economic elements of the business of government as distinguished from the political elements. At such times, unfortunately, his decisions are usually guided by his emotions rather than by reasoning based on intelligent and dispassionate analysis of facts. Possibly that is one reason why services that communities might properly transfer to a service-payment basis continue to be sustained from the general tax roll.

At present the expense of constructing and operating most community facilities is met from general taxation. The principle of charging for a service in proportion to the use that is made of it applied only in a limited field, although where it is employed the service is usually well administered and financially sturdy. In light of the alleged inequities of the tax on property, consideration can well be given to a survey of the field of municipal services with a view to the possible extension of the service-charge principle, to determine its limitations, to judge of its advantages and to assess its difficulties.

Let us begin with the service in which the principle is most familiar.

Water supply

Of the basic services, water supply has almost uniformly been put on a utility basis and made self-supporting. The rates are made to meet the full cost, including fixed charges. In the greater communities where large capital expenditures are required to protect future sources of supply, the self-support-

ing basis may be limited to the cost of the plant in use and its maintenance and operation, with the interest and sinking-fund charges on expansion investment spread on an ad valorem basis, as a ready-to-serve charge imposed on all property, vacant or improved. Such a division is in line with the modern theories of equity in apportioning the costs of public improvements. Generally speaking, municipal utilities find it difficult to make the rates cover a modest reserve to meet low consumption in periods of depression. Private utilities are generally better circumstanced in this regard.

Sewage disposal

The disposal of sanitary sewage is really an extension of the business of water supply. The water delivered must be returned in some manner to the natural drainage channels, and the cost of such disposition may reasonably be considered a part of the cost of supply.

The water delivered is of the same quality for all deliveries, and the cost to the user varies only with the volume used. The water taken away has been charged with pollution in different degrees by different users.

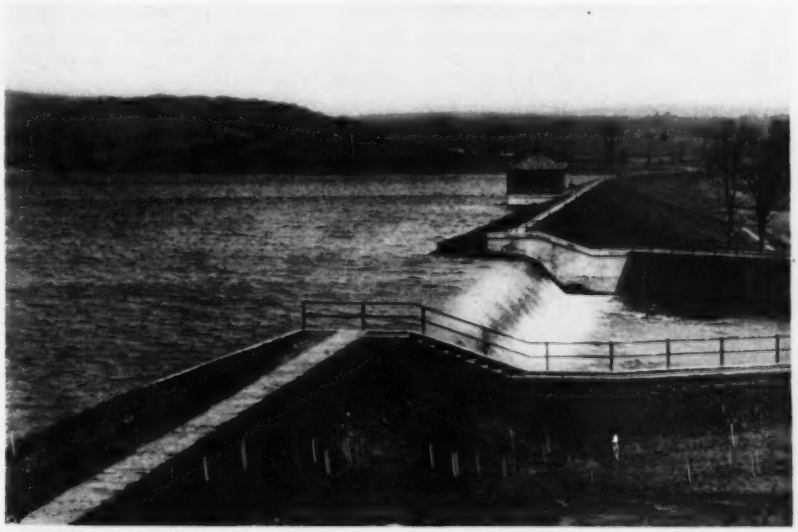
The cost of eliminating this pollution before returning the water to natural channels may not vary wholly with volume but should also carry a charge graduated with the degree of pollution added by different forms of waste. The indifference of the average citizen as to what becomes of sewage, as long as it is removed from the individual premises, changes to immediate concern when it is found that failure to remove the pollution brings a penalty in the form of heavy damage suits from other communities taking their water supplies from the contaminated streams.

Legislation permitting communities to operate sewage-treatment plants as utilities has been passed in eleven states. It generally provides that the facility shall include sanitary sewers, interceptors, pumping plants and the treatment plant, and be operated either as a private or municipal utility and on the same basis as water, gas and electric utilities. Already 104 cities have placed sewage disposal on a utility basis, and the subject has passed from the stage of theoretical discussion to a stage where the economic values may be determined from comparative cost records.

In general, the cost of treatment and disposal of sanitary sewage amounts to around one-third of the charges for water supply. Economic administration distates that both services should be under the same management.

Storm sewers are really a form of flood protection for which all property, vacant or improved, should pay. The cost should properly be met from the general tax roll even though the storm sewers may be in part or in whole used as carriers of the sanitary sewage.

Bayonne Bridge across Kill van Kull, connecting Bayonne, N. J., and Staten Island, N. Y.



Alcove Dam and main storage reservoir for the water supply of Albany, N. Y.

Garbage and rubbish disposal

The collection and disposal of garbage and rubbish is a service that is generally handled by administrative forces and paid for from proceeds of the general property tax. It is not easy to divorce the collection service from direct administration. There are complications involved in determination of equitable rates and in difficulty of enforcing disciplinary measures. The service is too intimately associated with maintenance of general health to permit relinquishment of direct administrative responsibility.

Modern practice in disposal of this form of waste tends toward incineration of garbage and rubbish in district plant units. It is not impracticable to put the whole service on a utility basis, and it is so handled in some cities. It is merely inconvenient from the viewpoint of physical operation.

The consensus of opinion among municipal engineers seems to be that the service of collection and disposal could well be handled on a contractual basis at a lower cost than by administrative forces, even though payment might continue to be by appropriation from the general fund. It is generally considered impracticable to put garbage disposal on a utility basis that would be comparable to that of sewage disposal.

Roads and streets

The advent of the automobile, which made it possible to increase greatly the use of individual transportation, resulted in the demand for new forms of thoroughfares better adapted to the use of a greater volume of individual vehicles. In cities the cost of satisfying this demand has largely been considered a community charge and has been met

from the general fund through the property tax. In a few cities a special license tax has been imposed upon motor vehicles in the attempt to meet the extraordinary expense of satisfying this demand for street space.

Outside of cities the cost of creating the improved road system demanded by the use of the automobile has been met by a direct tax upon motor vehicles in the form of registration fees and weight fees, and by a tax on the fuel used. In general, however, this revenue is wholly absorbed by the state and counties, and is applied specifically to the creation and maintenance of roads. Generally speaking, no part of the fees so paid has come back to the cities.

The facilities demanded of cities by this new form of transportation are not confined to the creation of greater street space. The costs of traffic regulation and control, traffic police, traffic lights, traffic courts, accident prevention, street lighting and so on have continued to be borne by the general property tax aided only by the returns from fines for violation of traffic ordinances.

The inequity of putting this cost upon real estate has been one of the greatest factors in the revolt of property owners against increased taxation. In many states this dissatisfaction has resulted in the retention of the proceeds from motor-vehicle and gas taxes in the general fund, and they have thus been used to meet current requirements of direct welfare relief. A much wiser and more logical application of these taxes would be to employ them in improving the street system of cities to accord with the betterments in the general road system outside. If definitely allocated for such specific purpose, it would make possible the creation of thoroughfares through slum areas and thus insure their rehabilitation in the common interest of stabilization of property values and freedom of traffic movement.

Rapid-transit lines

The transportation of passengers in public transportation facilities is paid for through fares and does not appear on the general tax roll. Modern thought on this subject, however, leans very strongly to the idea that the structure carrying rapid-transit lines, whether elevated or underground, is in effect a new street and should be paid for by the community in the same manner as a new street is paid for—partly through ad valorem taxation and partly through contribution from property directly benefited.

Much thought and study has been applied in recent years toward setting up an equitable basis that would distribute the costs in accordance with the benefits received, and some progress has been made along that line. The generally accepted theory among students of this problem is that the structure itself should be paid for by the community at large and by the contribution from property of some part of the increment of value that attaches to it by reason of the presence of the facility. Such an assessment cannot be determined with reasonable accuracy until after the facility is in operation.

It is further maintained that the rider should pay only the cost of equipping, maintaining and operating the facility. This is the view which in practice is frequently applied to water-supply and sewage-disposal projects, as has been indicated in the discussion of those facilities. In transportation, however, the practice of carrying the whole cost through fares has been so long established and is so favorable to private property interests that proposals for more equitable solutions arouse organized opposition and are almost invariably defeated.

Widened highway through Delaware Water Gap provides access to the Pocono Mountain playground in Pennsylvania.

Summary

All these basic services must necessarily be built to be of service for a considerable period in the future. Investments are involved that are not in their entirety necessary to meet the immediate requirements. A complete pay-as-you-go method of paying for these improvements is, therefore, considered inequitable as imposing too much on the present group of users. Equity demands that the construction investment be funded on a long-term basis with the interest and sinking-fund charges carried by the community at large, leaving the equipment, maintenance and operation to be paid for by users directly.

In any change of established methods of payment for community services people must be educated to the values and probable economies to result. This takes time—much more than is usually appreciated. By long usage everybody expects that the cost of additions to water-supply systems will be met by water rates. On the other hand, the transfer of sewage disposal from the general tax roll to a service-payment basis, while entirely analogous, is likely to meet with widespread opposition. To add to the difficulty of such a procedure, it involves a determination of the amount of total sewer investment that should properly be charged to storm-sewer account and the amount that should be charged to sanitary-disposal account. Statutes and charter provisions have to be amended to permit these changes to be legally made and to provide for issuance of revenue bonds for new construction.

This situation in municipal public-works projects is one of the reasons why such a small amount of the national credit, made available for financing self-supporting projects under the Emergency Relief and Construction Act of 1932, has been used so far. It is not that the work is not available and necessary, but that the municipalities found themselves, through the necessities of securing new legislation, amending charters and changing accounting and administrative procedure, unable to respond quickly to the financial opportunity offered.

The service charge in connection with public facilities has a number of important advantages, and it could with propriety be extended beyond its present field of application. To make a change from the present system, however, is made difficult by the forces of inertia.

General recognition of these advantages, coupled with closer coordination in study of methods and in particular the advance planning of construction programs so as to be in readiness to utilize favorable conditions, is certain to effect great changes and great economies in the future administration of municipal activities.

PUBLIC CONSTRUCTION AS A STABILIZER

PHYSICAL PLANNING—*Harold M. Lewis*
A FEDERAL BUDGET—*Donald H. Sawyer*
FISCAL RELATIONS—*Leo Wolman*

WHEN the lean years eat up the produce of the fat years even the thrifty man is made poor. This is the lesson of the ages. Can modern genius check the great swings from prosperity to distress? • Many men hold that when declining business discharges its workers they should be employed on public improvements. • The world is beginning to learn how it can plan its extensions and program its improvement work. • It must now learn how to apply this new knowledge and how to deal with the complex physical problems of timed public construction.

Determining Community Needs in Advance

Harold M. Lewis
Engineer, Regional Plan Association, New York, N. Y.

BEWILDERED by downward trends in transportation statistics, financial resources and realty values, public officials have been at a loss to know how they may proceed with public works. The question is asked: "How can we determine future needs?" The fact is overlooked that public works of various types have been successfully planned in advance for many years. It can be done today, provided a sound plan for general city growth is prepared and tied in with regional plans for metropolitan areas.

A municipality without a plan is like a ship without a rudder. It is too apt to be driven where the winds of varying political pressures and selfish private interests may force it. On the other hand, our national capital is still following the lines of growth laid down 140 years ago by Major L'Enfant under the guidance of George Washington. A part of the boulevard system of Paris planned by Baron Haussmann in 1857 was finally completed in 1928.

An example of the progress made on recent plans is found in the announcement by the New York Regional Plan Association a few weeks ago that during the four years ending with 1932, 550 miles of the major regional highways proposed in the plan of 1928 had been built, extensively rebuilt or placed under construction, a mileage equal to 22 per cent of that in the entire system.

A plan of future growth and an orderly program for carrying it out makes possible a budget for public-works appropriations. In this way an even rate of growth, expenditures and employment will be encouraged. If thereby the large appropriations of future boom times can be diverted to fill up the low points of future depressions, a repetition of present ills may be largely avoided.

Long time required

A long period of time may be required between the inception of a special project and the starting of its construction. This varies with the type of project, as will be brought out below. It may include a long period of education as to the need of the project, the arrangement of cooperation between public and semi-public bodies, the setting up of new legal machinery or the amendment of existing laws, lengthy proceedings for the acquisition of property and long negotiations in obtaining the necessary appropriations.

Advance planning for merely one type of public facility is not enough. Comprehensive planning is required. A generation ago conditions were different. Since then the modern city has become a complex machine. The extent and distribution of its growth depends on many things. They are all closely related. Plans for isolated projects are likely to be based on premises that will prove to be false. Highways, public buildings, bridges and tunnels may be found to have been built in wrong locations, placing a strait-jacket on the community rather than promoting its development along the best lines.

Two types of plans

There are two distinct types of plans, the difference between which should be clearly realized. The first of these is that which has been referred to in recent city-planning legislation as a "master" plan. Such a plan is somewhat diagrammatic, but comprehensive and farsighted. It sets up an ideal which, under existing conditions, seems to be still possible of attainment. It is not rigid, but requires constant adjustment as time goes on, and provides merely a basis for judging the fitness of different projects. Such a plan can look forward about a generation, the length of time depending upon the probable rate of growth of the area to which it applies. From the point of view of existing political agencies, it is almost an ultimate plan.

The second type of plan is the "official" plan, which can be adopted by the governing agencies as part of a definite program of future construction. This

adoption should be sufficiently binding so that improvements conflicting with its execution could not be made except upon a temporary basis or by amendment of the official plan. It is a specific plan, more detailed but less comprehensive than the master plan, providing for the execution of what the latter may have shown in a more general way. The two should not conflict. The best illustration is the official map for city, borough, village or town plans authorized under the present city-planning enabling acts in the states of New York and New Jersey. A similar procedure is quite suitable for some of the large governmental agencies, such as counties, states or the federal government. The official plan should not look so far ahead as the master plan, but may include some projects that would not be carried out for 10 or even 25 years.

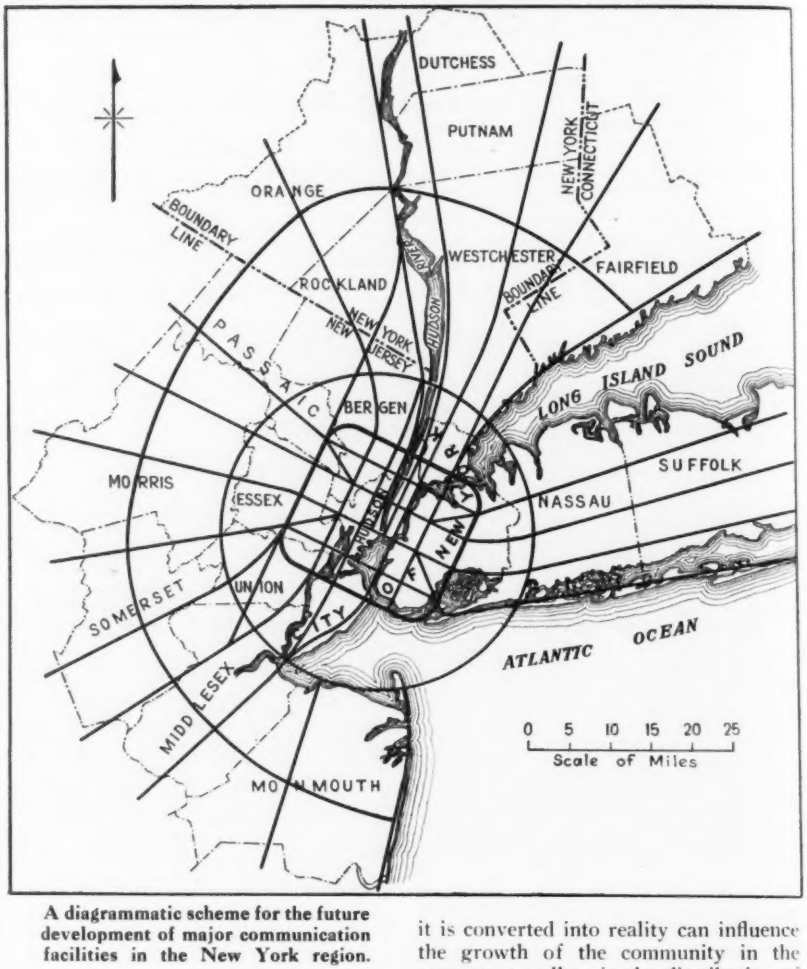
The period of time to which the different elements of a plan for the future should look forward varies with the type of facility involved.

Population estimates

The fundamental element that must be considered is the probable future growth of the community, which is ordinarily judged by its resident population. Statisticians who have studied the 1930 population census of this country seem to believe that it denotes a decided change in the trends of our population growth and that the population of the entire United States may become stabilized within the next one or two generations.

In the past, population estimates have often been made with great reliability for as long as 25 or even 50 years ahead in certain municipalities. City planners have generally assumed that they were justified in planning a community for approximately double its existing population. If the statisticians are correct in their deductions, this would not be a safe rule to follow in the future. On the other hand, many communities have recently increased their population so rapidly that, even within the last five to ten years, estimates of double the then-existing population would have been much too conservative for a long-time plan. For example, in the New York Metropolitan Area, Nassau County on Long Island increased 140 per cent in population during the decade ending with 1930. In the same period the population of the Borough of Queens in New York City increased 130 per cent. Of the United States cities with more than 100,000 residents—Los Angeles, Houston, Chattanooga and Oklahoma City all more than doubled in the same decade; Long Beach (California) grew to more than two and a half times its former size, and Miami became almost four times as large. In contrast, Lowell, Mass., lost 11 per cent of its population, and the Borough of Manhattan in New York City lost 18 per cent.

It should still be possible to obtain reliable population estimates for the next 25 years for the larger communities. The more self-contained a community is, the easier it is to predict its population. The growth of a small community within a metropolitan district may be materially altered by conditions difficult to foresee. For a community undergoing sudden changes, due to industrial migration, or subject to "mushroom" growth, as the result of a new transportation link to a metropolitan center, it is probably not feasible to obtain reliable population estimates for more than fifteen years ahead.



A diagrammatic scheme for the future development of major communication facilities in the New York region.

It is important to realize that a city plan, which is progressively carried out, may itself have a very strong influence on the growth of a municipality. It has been clearly demonstrated in New York City that population follows rapid-transit lines. Excluding the Borough of Richmond, which is without such facilities, it is found that about 91 per cent of the population in the other four boroughs lives within one-half mile of its subway and elevated lines. Therefore, the problem is not so simple as determining the future population and designing a plan to serve that number of people. To a considerable extent the plan itself and the energy with which it is converted into reality can influence the growth of the community in the amount as well as in the distribution of its population.

Comprehensive plan first essential

Due to the close relationship between the different facilities involved in a city or regional plan some comprehensive picture of what the future city or region will look like is essential before programs can be prepared to cover any one type of facility. This plan should probably look forward from 25 to 40 years, but it should be of the type referred to above as the master plan. It should be constantly adjusted to meet changed conditions resulting from new trends in transportation or improved standards of development. Such a comprehensive plan should include the major methods of communication by railroad, highway, rapid-transit or air transport, provision for adequate open space in parks and playgrounds, a general classification of the areas required for industrial, commercial and residential uses and provisions for the sites of public buildings.

The main purpose of this plan is to guide the future growth of the community along efficient and desirable lines and to prevent building developments and land uses that will conflict with such future growth. It does not in itself supply a public-works program.

but supplies the framework into which the various items of such a program should be fitted.

Highways

Highway construction probably provides the largest item in a budgeted public-works program because the highway network covers such wide areas. In forming a program for highway construction, the major links in the highway system, which might be classified as primary routes, must be considered separately from secondary trunk-line facilities.

The primary routes would be the main highways connecting important population centers and in many cases would involve costly waterway crossings. This is particularly true in such an area as the New York region. As the traffic on such routes depends on conditions over wide areas rather than upon local conditions, their future requirements can be estimated for some time in advance. For example, estimates prepared in 1925 by the Regional Plan of New York and Its Environs for vehicle traffic up to the year 1950 across the Hudson River, between New York City and New Jersey, still seem to offer a basis for a future program of new crossings after seven years of the period have passed. New facilities added within that time, such as the Holland Tunnel and George Washington Bridge, have increased the amount of traffic well above the estimates, but this now appears to have been a temporary variation, due to the initial impetus of new traffic created by these facilities. Any 25-year estimates are certainly likely to need revision, but it would seem that traffic on major highway routes, as defined above, could be reliably estimated for fifteen to twenty years in advance.

The requirements of secondary trunk-line highways are more subject to variation. The important thing in selecting such projects for an immediate program is to make sure that they fit into such a comprehensive plan as is suggested above. Such routes form the major parts of city plans, which would of course also include the primary routes, although the latter are often regional in character.

It has been customary for city planners to include in their reports definite programs for carrying out street thoroughfares. For example, in the "Plan of New Rochelle, N. Y.," the Technical Advisory Corp. submitted a seven-year program of construction. In the "Street Thoroughfare Plan" for Rochester, N. Y., Harland Bartholomew presented a list of projects to be carried out in five to ten years, this being only a small part of the complete plan. In the "Thoroughfare Plan for Boston," Robert Whitten presented a construction program of three stages, which, it was stated, would require a total of 15 to 25 years to carry out.

Except in the case of new communities, street thoroughfare plans will include a certain amount of replanning involving the widening of existing streets. In large cities this has entailed tremendous expense. For example, the cost of widening Olive St. in St. Louis was about $1,374,000 a mile, and the widening of Tremont St. in Boston was at the rate of about $4,504,000 a mile. Detroit has found an extensive program of street widenings in the central area essential for the development of an adequate system of vehicular circulation. Through the use of building setback lines and official map lines within which future buildings are excluded, city plans adopted now may avoid such excessive costs for future street widenings.

In general, the writer believes it is desirable to develop a definite program for the improvement of secondary thoroughfares to be carried out over a period of five to ten years

Remedying inadequate traffic facilities in the downtown sections of cities is always a costly procedure. This picture shows the extension of Sixth Ave., New York City, necessitated by the opening of the Holland Tunnel (low left).

Railroads

The carrying out of railroad proposals involves the cooperation of railroad companies, municipalities and public-utility regulatory bodies, either state or federal In a community served by only one or two railroads the problem may be quite simple In the port of New York, served by eleven trunk-line railroads, it is highly complex. The Port of New York Authority, established in 1921, placed in operation in 1925 the first of its belt-line railroads (Belt Line No. 13 on the New Jersey waterfront). It was not until 1932 that it opened its first union inland terminal for less-than-carload freight. The construction of its middle belt line, which forms the keystone of its rail proposals, is still under negotiation. A plan for the electrification and improvement of the New York Central Railroad on the West Side of Manhattan in New York

City was completed in 1916. Due to a change of city administration the plans were tabled; it was not until thirteen years later that quite similar plans were finally approved so that construction is now under way.

Twenty-five years would seem to be a reasonable minimum time to which railroad plans should look forward.

Sanitation

An adequate source of future water supply is essential for every municipality. The requirements are in proportion to the population to be served, the use of water per capita generally showing a gradual increase. For large metropolitan districts, which may have to go great distances to secure their water supply, it is desirable to plan ahead for at least 25 years and to have some approximate plans for 50 years ahead.

In New York City it is estimated that it will take about ten years to bring Delaware River water, the next large source of supply, to the city after construction of the works involved has been started. It is obvious that this requires a carefully prepared construction program for many years ahead. In smaller municipalities, with additional supplies within easy reach, a ten- to fifteen-year program may be all that is required.

As a part of new water sources, plans are required for the main elements of the distribution system. This should be planned far enough ahead to avoid local water shortages, due to such sudden population growth as has occurred in the Borough of Queens, New York City. A ten- to fifteen-year program would seem to be desirable for such facilities.

Another part of the sanitation problem that should be planned ahead is the provision of main sewers and sewage-treatment plants. In the case of the latter, long periods of education may be required. New York City furnishes another interesting example. A New York Bay pollution commission was established in 1903, and a general plan for the purification of tidal waters in New York City was presented by the metropolitan sewerage commission in 1914. The first treatment plant to deal in any comprehensive way with the purification of the Harlem and East rivers, the most contaminated part of these waters, was placed under construction on Wards Island in June, 1931. It is scheduled for completion in 1935, 32 years after the establishment of the bay pollution commission.

This is an exceptional case, and in general it may be stated that a program for the construction of sewage-treatment plants and main sewers for the larger cities should be planned at least twenty years in advance, while the general requirements should be mapped out about 30 years ahead. Preliminary reports in 1931 by the board of sanitation, New York City, looked forward to the year 1960.

Public buildings and parks

City plans deal with the location of public buildings rather than their detailed plans. For any definite program for their future construction it is advisable to plan the location of such buildings many years in advance, particularly when forming a part of a civic center; but the definite planning of such structures probably need not look forward more than five to ten years.

The requirements for park areas are based both on standards of percentage of area that should be devoted to such use and on requirements per unit of population. Park areas must be acquired or definitely placed upon the official maps some years in advance of their need for intensive use, otherwise conflicting developments will make their future acquisition too costly to be practicable. A program for park acquisition for the larger parks of city-wide or regional importance should look forward at least 25 years, and in some cases much further. Central Park in New York City was acquired in 1858 and at that time was entirely outside the built-up area. While it was 50 years before the city had surrounded it, its acquisition came none too soon.

Local neighborhood parks and playgrounds are now in many cases required to be dedicated by subdividers. When this is done they do not need much advance planning in such areas and, as no expense is involved, their acquisition does not come within a program of expenditure for public works. In our older cities, however, which are badly overbuilt in certain sections, it has become necessary for the municipality to acquire local parks and playgrounds in built-up areas in order to conserve health and property values. A program for park and playground acquisition of this type should look forward approximately ten years.

An air view of Radburn, N. J., a community that was completely planned in advance. The layout is such that it is possible for a pedestrian to go to any part of the community without crossing a roadway.

Planning should be comprehensive

There is thus ample evidence that future needs in the way of public works have been and still can be accurately determined in advance. The difficulty has been primarily in the coordination and budgeting of different types of facilities so as to effect a logical and orderly carrying out of the plans. When they are part of a comprehensive program embodied in a sound city or regional plan, this problem is greatly simplified.

All public works, whether municipal, county, state or federal, according to their scope and character, should be parts of such a program. Comprehensive planning of future needs is therefore a first essential. It should show at a glance what facilities are most urgently needed to supplement what are already available.

As part of a city or regional plan for physical development, there should be a master plan looking forward 25 to 40 years. The official programs for facilities to be fitted into the general framework should be planned for the estimated future needs of the next 5 to 25 years, varying with the type of project.

We cannot stand still. Let us look forward rather than backward. As stated by Mr. Robert D. Kohn, chairman of the Committee on Trade Recovery in the *Architectural Record* for April, 1933, this means:

> Ideals and ideas are the only assets left to any of us. I venture, then, this prophecy. We shall have of necessity a decade of public-works construction and rebuilding of our cities and the building up of new and smaller industrial centers, all on a scale never before realized.

Wasteful projects cannot be tolerated in view of the general need for economy. Yet "made work" for unemployment relief is largely wasteful. The sooner sound public work and its subsidiary private activities can be substituted for this type of employment, the farther along we shall be on the road to recovery.

Budgeting Federal Construction To Stabilize Employment

Donald H. Sawyer

Director, Federal Employment Stabilization Board, Washington, D. C.

In A Hopeful Effort to make use of federal construction as an aid to the jobless workers of the future, an employment stabilization board was set up by Congress two years ago. The Board's researches reveal a picture of past and present lack of program and bring out the equalizing possibilities of budgeted federal construction.

TWO YEARS AGO the Federal Employment Stabilization Board was created, as the outgrowth of a belief that the diversified construction activities of the national establishment afford a means of helping to equalize the large swings in employment that result from changes in the economic conditions to which business activity is subject. The studies of the board strongly confirm this belief, and now make it possible to show by specific example the degree of equalization that may be brought about by foresighted programing of public construction. They have brought to light an instructive picture of federal construction activities.

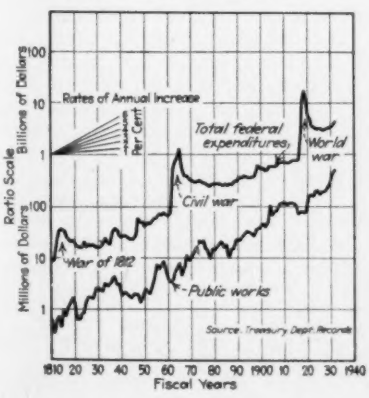
Diversity of federal public works

Public works are created by the federal government for many reasons.

In the early years of our republic the needs for federal construction were few; protection of life and property and national defense no doubt received first consideration. From these simple beginnings the construction activities of the government have broadened into many fields, due to the necessity for building works to serve the general good, works that are too vast or too specialized for individual undertaking.

More than 100 bureaus or independent offices of the government now are engaged in some form of construction or repair. Some of them carry on work of a similar nature, as roadbuilding; many agencies are doing road work of some kind, either for the use of the public in general or in connection with the operation of other government facilities.

Fig. 1—During a century and a quarter the public works of the federal government and the total federal expenditures followed parallel lines of increase.



Size and importance

During the pre-depression years the federal expenditure for construction accounted for less than 3 per cent of the total volume of construction, but during 1932 it reached 13 per cent of the total, due to simultaneous increase in federal construction and decrease in other public and private construction.

For more than a century the government's expenditures for public works have averaged about 10 per cent of its total expenditures and have followed closely along a uniform ratio line, as is brought out by the curves charted in Fig. 1. This uniform trend corresponds very closely to the composite trend of national production and wealth, as the charted curves of Fig. 2 make evident. These curves also show that construction has increased faster than population, which is only to be expected with our continually rising standard of living and our ability to pay for national improvements.

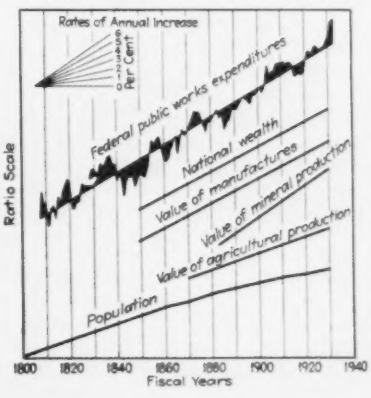
For the past decade (1921-30) federal construction and repair, as shown by the table below, averaged $242,000,000, or 7.1 per cent of the government's total ordinary expenditures ($3,381,000,000). Deduction of federal aid for roads ($82,000,000), to allow comparison with the relation that existed for the preceding hundred years, leaves only $160,000,000 for construction and repair, or 4.7 per cent of total federal expenditures.

The United States has expended more than five billions on federal works since 1789. The present value of its plant is unknown, but if it was $3,000,000,000 in 1923 (Federal Trade Commission's study of national wealth and income), its present value would be considerably higher, as an additional $2,300,000,000 has been expended on plant since that date.

Major items in federal construction cannot be segregated by type of construction but in general only by agency. The division in per cent of the year's total is shown by Table II. The distribution is shown separately for the decade 1921-30 and for the two-year period 1931-32, as during the latter period the total mounted to 22 times the average of the preceding decade. Nearly all the constructing agencies shared in the increase, though not equally. It should be noted that the table does not include repair (about 1½ to 2 per cent of the value of the federal plant) or federal aid to roads (this money being actually spent by the states).

In the past the entire cost of permanent federal construction has always been borne by current revenues. An extraordinary budget for capital investments has been advocated in recent years. Strong reasons are advanced both for and against such a plan of financing,

Fig. 2—Comparative growth trends of wealth, production, population and federal public works indicate that construction needs are due to the composite effect of numerous factors.



but from the viewpoint of proper budgeting set-up rather than financing the segregation of construction items from all other budget items would be of tremendous value to the Stabilization Board in its planning program of public works.

Stabilization of construction

Beyond question the instability of construction volume — this volume amounted to nearly 11 billions in 1928 and 1929, but declined to less than 3 billions in 1932—periodically accentuates industrial booms and depressions. Construction is one of the major economic forces, and therefore can be used to aid stabilization.

Normally more than two million men are employed directly in construction, and four or five millions indirectly in manufacturing and transporting its materials; these millions, when employed, are enabled to buy homes, furniture, automobiles, radios and all the other things that enter into industrial and business activity. Federal Reserve Board data demonstrate that at present the machine of business is slowed down primarily because of a lessened demand for durable products (such as steel, lumber and glass) and not because of the smaller demand for non-durable products such as foods, textiles, leather goods and tobacco. *The construction industry uses directly more than one-third of these durable products.* What does this mean in terms of employment?

The Stabilization Board's index of construction materials employment, based on six major industries and covering some 330,000 wage earners as of 1929, shows that 15 per cent of this branch of construction employment is located in Pennsylvania, 11 per cent in Ohio, 9 per cent in Illinois, 8 per cent in New York, 5 per cent in New Jersey, and over 4 per cent in California, Indiana and Alabama. In other words, more than half of the materials used in construction comes from eight states. A large public-works program thus benefits the industrial centers as well as the states in which the projects themselves are located.

Advance planning of public works makes it possible to utilize this widely distributed employment to prevent part of the extreme cyclical fluctuations of industry. Construction expenditures have fallen by 70 per cent since 1928, and the physical volume of construction (allowing for a 25 to 30 per cent drop in costs) has fallen by nearly 50 per cent; employment in the material factories has fallen by 60 per cent. If states, counties and cities had been able and willing to follow the example of the federal government, the dollar volume of construction would have remained almost constant.

TABLE I—CONSTRUCTION EXPENDITURES OF THE FEDERAL GOVERNMENT

Fiscal Years	New Construction	Repairs and Alterations	Total
1920	146,221,000	55,414,000	202,636,000
1921	173,731,000	60,028,000	233,759,000
1922	160,812,000	42,375,000	203,187,000
1923	142,377,161	39,684,000	182,061,000
1924	168,816,005	45,286,000	214,102,000
1925	205,604,000	51,747,000	257,351,000
1926	176,276,000	56,063,174	232,339,000
1927	173,755,000	58,640,000	232,396,000
1928	188,378,000	63,639,000	252,018,000
1929	220,560,000	66,861,000	287,422,000
1930	251,468,000	69,895,000	321,364,000
Av. 1921-30	186,000,000	55,000,000	242,000,000
Excl. Fed. Aid	105,000,000	.....	160,000,000
1931	391,475,000	72,068,000	463,543,000
1932 (a)	481,137,000	75,092,000	556,229,000
1933 (b)	706,374,000	68,196,000	774,571,000

(a) Partly estimated.

(b) Appropriations.

Note: Table does not include expenditures of the District of Columbia municipal government.

TABLE II—DISTRIBUTION OF FEDERAL CONSTRUCTION EXPENDITURES

Agency or Kind	Av. 1921-30 Per Cent		Av. 1931-32 Per Cent	
War Department				
Rivers and harbors	32			
Flood control	9			
Other War Dept.	7			
		48		42
Interior Department				
Reclamation	7			
Indian Affairs	2			
Alaska R.R.	2			
National Parks	2			
		13		13
Navy Department				
Yards and Docks		9		5
Agriculture Department				
Forest Service	8			
Other	1			
		9		9
Treasury				
Supervising Architect	6		16	
Coast Guard & others	3		2	
		9		18
Veterans Administration		4		5
Inland Waterways		1		1
Panama Canal		1		1
Commerce, Justice, Labor, State Departments and Post Office		3		3

Planning federal public works

The benefits of long-range planning extend beyond employment equalization. Planning necessitates analysis of future requirements and establishment of a financial program and of suitable priorities. This means economy.

Six-year advance planning of federal public works is being carried out under the terms of the stabilization act. It enables those responsible for supplying the funds to decide more easily on the justification for appropriations. It is comparatively simple to class certain projects as necessities and to assign them priority, and to class others as luxuries; the largest group, and the one most difficult to appraise, lies between these groups. To assist in rating projects certain criteria may be set up as a guide in fixing priorities, thus:

a. Projects under construction or contract.

b. Projects necessary for protection of life.

c. Projects necessary for the conservation of natural resources.

d. Expenditures for sustaining the physical property of the government.

e. Expenditures for the protection of property.

f. Construction for housing government activities.

g. Facilities for necessary public services whose income would not justify private investment.

h. Works of reproductive value.

i. Works to replace obsolete facilities.

j. Works desirable for public convenience and comfort.

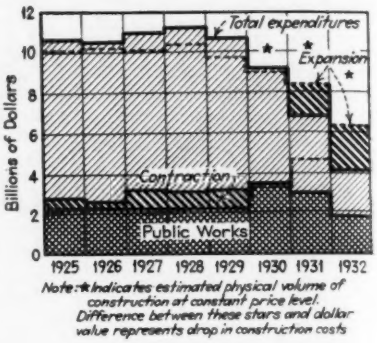


Fig. 3—An illustration of what could be done to smooth out construction employment by deferring public works in fat years and holding them in reserve for the lean years that may be expected to follow

k. Facilities which if not built by the government would be furthered by states, cities or private enterprise.

Such a list is not to be applied hastily or mechanically, of course, for a project falling in a lower classification may have, on closer analysis, to be of greater necessity and importance. The past trend of expenditures of the particular agency concerned is also significant as an indication of warrant. In some cases this trend is uniform, in others irregular, but close examination will normally show whether an irregularity is natural and legitimate or whether it results from an unwise program. The normal program, in any event, should provide for such construction as will serve the best interests of the nation, furnishing those facilities that are necessary and desirable, and yet limited to economically justified expenditures.

New needs develop

That past trends cannot alone be a guide may be seen upon recalling that the development of air transport in 1926 and thereafter necessitated much federal construction not previously required, in the form of airways and beacons. Exactly the same situation resulted earlier from the spread of automobile transportation, calling for roads and bridges in large volume, facilities that could be provided satisfactorily only through governmental expenditures.

It is for such reasons that the sum total of public construction, from decade to decade, has been an ever-mounting figure. And yet, as already shown, the percentage increase has been remarkably constant—almost exactly 5 per cent annually since 1810!

When business is slowing down it is desirable that government take up the slack by federal construction. For this purpose adequate advance planning supplies a reservoir of ready projects, with the advantage that the work selected is part of a consistent plan. Floundering about on the spur of the moment for work to be done may result in discon-

nected undertakings of doubtful utility.

All that has been brought out applies with special force to states, counties and cities, as these normally spend about ten times as much for public improvements as the federal government. Whatever benefits may be derived from federal advance planning will be greatly magnified in the larger local field. Year after year hundreds of millions of dollars are expended on public works, selected and controlled almost wholly by momentary public enthusiasm, emotional appeal, or pressure from special-interest groups.

Increasing attention is being given to the advance planning of public works by states and cities, to some extent also by counties. At present it is receiving most attention from states, largely as a factor in state-wide stabilization of employment and industry. Many cities have worked out programs of improvements in special fields, such as water supply, and several cities are now engaged in working out long-range programs which embrace all public works.

The question, then, is not whether state and local governments can or should engage in this activity, but how soon they can put it into operation. There are great opportunities ahead for all governmental units in long-range programing of public works to bring about orderly and economical construction, to assure judicious use of public funds and, most important of all, to equalize employment and industrial variation between good times and poor.

Financial Aspects of Budgeting Public-Works Construction

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IF WE WOULD stabilize business through timed public construction we must foresee our physical requirements. This is possible today, as Mr. Lewis has set forth. Can we also plan financially so that money will be available? Professor Wolman finds the answer in conserving credit rather than in piling up large reserves.

STAGNANT business, idle industrial capacity and general unemployment are conditions which, in any country, are bound to invite proposals of relief, cure and prevention. When the familiar and ordinary processes of business appear to have broken down, it is inevitable that responsible governments should undertake to canvass new sources of employment and to weigh novel and untried measures of business recovery. With the persistence of the depression, the number of such measures has become legion. But in connection with almost every one of them, the proposal to utilize public works in some form or other invariably appears. The virtues of public expenditures in construction have, in fact, been so extravagantly praised that there has become attached to public works a magical potency hitherto associated only with inflation.

In practice, however, the use of public works as a factor calculated to influence the course of business is not one, but several distinct devices. Each rests on different theoretical assumptions and must necessarily be tried under quite diverse circumstances. In general it is possible to distinguish three separate public-works plans, two of which have to some extent been employed during this depression and, at any rate, have been subject to wide and vigorous public discussion.

Attempts to check depression

Of the two plans just mentioned, the first was fashionable in the last months of 1929 and during the larger part of 1930. Throughout this earliest phase of the depression, few people foresaw the intensity and persistence of the decline that was to take place in the next years. In so far as there was an opinion concerning the characteristics of the depression, the turn in business that began in 1929 was regarded as a brief corrective movement which would manifest itself mainly in the speculative security markets. Business was held to be fundamentally sound and in danger of getting out of hand only if responsible authorities failed to adopt appropriate measures of business stimulation. The problem, then, was to prevent the first relatively moderate losses in business from gaining momentum and developing into a major depression

It was to solve this problem that President Hoover urged upon his conference of business men the maintenance of prevailing scales of wages and the expansion of expenditures for plant and equipment. In consonance with this point of view and program, the administration likewise undertook to encourage public-works expenditures at levels at least as high as those of 1923 and 1929.

In support of the program, the theory was elaborated that the effectiveness of public construction depended upon the time and speed with which it was undertaken. The function of governmental expenditures was to head off the forces of depression and to prevent the decline of business to ever-lower depths. Or, as it was officially put, "the amount of public construction which it is possible to push forward in order to influence employment and the trend of business in a period of recession is less important than the timing of the acceleration. The psychological effect of advancing public construction at the right time suggests that here is to be found an important factor in the problem of maintaining a reasonable economic balance. If properly timed, as the pendulum of employment starts to swing in an unfavorable direction, the influence of the prompt expedition of public works is effective out of all proportion to its size. Timeliness multiplies the effectiveness of each project accelerated."

By any test of experience the elements of this program were as faithfully executed during 1930 as they possibly could be. Wage rates certainly were remarkably steady during 1930, and the large spenders of capital funds—the public utility companies, the railroads and local and central governments—maintained their programs of construction in exceptionally large amounts. The budget for public works alone equaled in 1930 the expenditures for each of the boom years, 1928 and 1929; and it is common knowledge that the capital outlay of the

public utility and railroad industries stood at a high level in the first year of the depression.

Large bond-issue plans

The failure of these measures is a matter of record. Indeed the failure was recognized by a drastic contraction in all expenditures of this type beginning in some cases in the last half of 1930. The theory of timing and acceleration was, then, for the time being rejected.

But it was very quickly replaced by the even more elaborate hypothesis that depressions of extraordinary magnitude are likely to become cumulatively worse unless they are arrested by the action of some fortuitous circumstance, such as war, a crop failure, an epoch-making invention and the like. Failing the intervention of uncontrollable forces of this nature, it became imperative to devise a practicable and effective substitute for them. And of the available substitutes, the release of large public funds for the purchase of materials and the payment of wages in the furtherance of projects of public improvements appeared the most natural and the most practicable of the available expedients. Out of this view grew the movement for the flotation of gigantic bond issues and the employment of the proceeds of the issues in the development of a nation-wide program of public works, designed incidentally to accord relief to the unemployed, but primarily to furnish the stimulus essential to the recovery of business. The amounts proposed for the prosecution of such a program have run from three to six billions a year, or, as in the plan of Prof. James Harvey Rogers, of Yale University, have been put at the rate of 700 million dollars a month, the expenditures to continue until the goal of business recovery has been reached.

Planned stabilization

The third variant of public-works programs is the traditional one. This plan, largely administrative in its outlook, envisions the use of public expenditures on construction as a potent factor in the long-time stabilization of business. With this end in view, it involves simply the postponement of public improvements from good to bad times. Postponement, if effectively and universally applied, would, its advocates believe, serve the two-fold purpose of restraining the tempo of business activity in times of boom, by withholding the substantial outlays of governments from the market, by safely stimulating business activity and employment during the depression and by concentrating the budgets for public improvements in precisely those years.

Each of these uses of public works presents its own peculiar financial problems. In a sense, the acceleration of expenditures in the very early stages of a depression appears to raise the issues of sound financial policy in their simplest form. At that time the memory of good business is still bright in the minds of most people; the duration of the depression is uncertain; and large public expenditures do not yet seem to expose the credit of the government to inevitable dangers. But these advantages are largely illusory, as our experience during this depression has clearly demonstrated. While the psychological atmosphere in the first months of the depression may be favorable to the expansion of government expenditures, the financial condition of local, state and federal treasuries is impaired, and not strengthened, by undertaking to add to outstanding tax and debt burdens at the beginning of what is destined to be a prolonged period of declining business, shrinking revenue and falling prices. If it be said that the character of a business cycle is not always apparent in the early stages of its course, the answer is that sound fiscal policy must in large part rest on the accuracy of such forecasts of the future and that the safest fiscal policy consists in taking a conservative and realistic view of the future.

The issues involved in financing an effective public-works program in the advanced stage of a depression are too familiar to require more than mention here. The technical aspects of budget-balancing have been thoroughly, if not convincingly, argued throughout the land. The capacity of the investment markets of the country to absorb the bonds of over-borrowed governments, federal, state and local, has become a question more of sentiment than of fact. Whether private enterprise must depend for its fillip upon the undertakings of government is one of those subtle and obscure issues of economic theory which, in the face of our national demand for prompt and effective action, may be settled only in the processes, often unpleasant, of experience. Whether, finally, the business of this country finds itself in such straits that the only way lies through inflation, and whether inflationary measures are susceptible of cool and rational control, may likewise turn out to be the type of economic questions which we can in this emergency settle only by the methods of trial and error.

Fiscal problems of reserves

Proposals for the financing of long-term programs of public works raise issues of a different kind. Essentially the problem is that of finding funds in large amounts during periods of depressed business. In the early discussion of this problem the term "reserves" was universally used to describe the general nature of the process, but little can be found in the literature by way of detailed analysis of public-works reserves and of the methods by which they can be properly financed.

Influenced largely by current discussion of the nature of unemployment reserves and by the dominant part played in the origins of this depression by the huge credit expansion of the preceding years, plans for the financing of forward programs of public improvement involve the setting up and segregation of reserve funds for this purpose in the prosperous years and the neutralization of these funds while business is on the upgrade. The theory of this proposal is elaborated in the final report of the Special Commission on Stabilization of Employment of the state of Massachusetts. Because of the fear that reserve funds affect "the supply of investable capital, and this in turn produces results upon the cyclical swings of business that are less favorable to stabilization," this commission recommends the deposit of reserve funds in the Federal Reserve Bank. "These deposits," the commission holds, "could then be sterilized by the Reserve Bank by a species of 'earmarking' as a special fund, if business conditions indicate overexpansion and contraction of credit is desirable. Part of these can be released on the market in short-term purchases at any time if credit becomes dangerously tight. The Federal Reserve Banks can thus be given a larger measure of control over credit and over cyclical fluctuations in business that are affected by credit than is now possible, while at the same time relieving the state of the necessity of investing and liquidating the funds on its own account."

Conclusion as to sound policy

The problems of raising unemployment insurance funds and of financing public construction are not identical. Unemployment insurance requires the creation and accumulation of reserve funds. How much the collection and distribution of such funds will affect the state of business depends upon their amount. European experience fails to show that the administration of extraordinarily large unemployment reserve funds has seriously influenced the tide of business.

So far as public-works reserves are concerned, it is, in the present state of our knowledge, the wiser policy to attempt no more than seems possible of effective achievement. The novel and ingenious method is to set up reserves and to keep them, in one form or another, for the future. But the tested method is to pursue in prosperity a policy of unprecedented restraint in spending public moneys for improvements; to finance the bulk of government activities through taxation and to reduce the burden of public debt. Where this is done, a government, relatively free of debt, can, like the government of the state of New York, easily finance the extraordinary requirement arising out of the condition of depression and can consequently, with less fear of impaired credit, undertake such programs of public works as wise public policy dictates.

HOW PUBLIC IMPROVEMENTS ARE BUILT

THE ENGINEER'S WORK—*Charles H. Paul*
CONSTRUCTION EFFICIENCY—*George B. Walbridge*

THE PUBLIC should receive its money's worth in public works. It expects that the funds spent on public improvements will be used wisely and efficiently. • To judge of this efficiency, we must appraise the skill and breadth of vision with which public works are conceived and the integrity and ability devoted to the actual construction. • Two nationally known figures, an engineer long engaged in planning and designing public works and a constructor of wide experience and recognition in contracting circles, discuss the quality of public-works construction.

Public Works Are Ably Planned to Serve the Community

Charles H. Paul
Consulting Engineer, Dayton, O.

SUPPOSE we were able today to take any ten miles of modern concrete road in our vicinity and exchange it for its original cost in money. Despite these times of economic stress, when money is so urgently needed for so many things, even for poor relief, would we make that exchange if we could?

Would we, if we could, sell back our modern highway bridges at cost, replace them with the former structures and use the money today for some other purpose? Why not? Because these modern public improvements fill a present-day economic need, and *they could not reasonably be replaced with less adequate facilities* even at a time when individuals, corporations and governments are stretching budgets to the breaking point and searching in every direction for hidden balances or otherwise available funds.

But how about the new office building across the street? If they could, would not the owners or the bond-holders exchange that building today for what it cost in money, or the bonds for their face value?

Would not many a new home-owner in the "exclusive" residence plat, be willing today to sell back his three-year-old $50,000 home for its original cost, in cash, and go back to his former comfortable though more modest quarters? Could he find a more desirable use today for that $50,000?

Here we have a crude, and admittedly somewhat inequitable, comparison between some recent investments in public works and in private enterprises. Frankly, selected cases have been chosen to accentuate a point that will now be discussed in more deliberate fashion, namely: that public works, generally, are well planned to meet existing or immediately forthcoming demands, and that, as a rule, *we find our public works fully justified from an economic standpoint.*

Public works today, taken by and large, show evidence of skillful planning and competent execution. Many of them are outstanding in these respects. Most of them will hold their own in comparison with similar works controlled by private agencies. This is said in full realization that occasionally we see a glaring exception that by itself would give good cause for the contrary opinion.

There are several factors that contribute to the adequate planning of our public-works programs. In spite of certain notions to the contrary, it is a fact that the technical men in public service usually are competent and well equipped to carry out the work assigned to them. Where better would we go than to the Bureau of Public Roads to find the latest word on design or construction of road pavements? Where could men be found more competent to design a modern concrete highway bridge than those in many of our state highway department offices? Recall the standing of the engineers who planned and constructed the works of the Metropolitan Water District at Boston, or those of the New York water supply. The state capitol building at Lincoln, Neb., and the new city hall at Los Angeles were not designed by amateurs. The technical reports prepared by the engineers of the Miami Conservancy District, Ohio, have been in demand by engineers all over the country and are used in many places as textbooks.

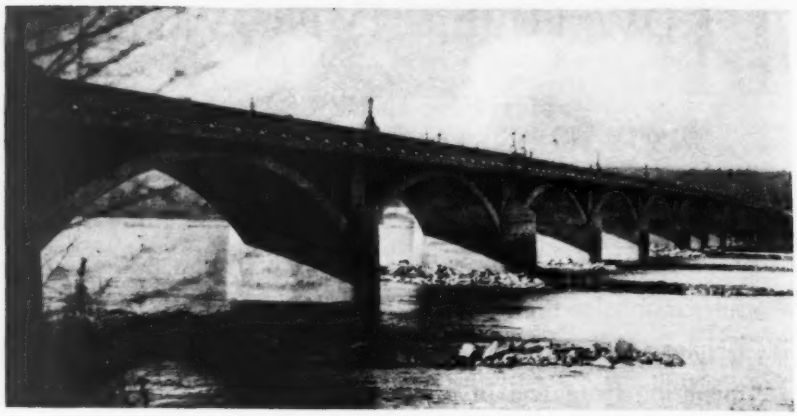
The famous Los Angeles aqueduct was the result of the combined ingenuity and skill of a highly-competent engineering organization. It is safe to say that almost any question on design of a dam, of whatever size, type or purpose, can be given an authoritative answer by the engineers of the U. S. Bureau of Reclamation, who are now making history in technical achievement on that outstanding public-works structure, Hoover Dam. The engineers of Wayne County, Mich., were designing and building serviceable concrete roads long before public opinion in other localities was convinced that such use of concrete had passed the experimental stage. The Panama Canal meets the tests of time, and no less now than when it was completed, it stands as a monument to the ability, courage and resourcefulness of

American engineers and constructors. These are only a few of the many public works projects that testify to the skill and efficiency of our technical men in public service.

Even in departments where old-style political control is conspicuous, the technical details of public-works planning are usually in the hands of competent men. And this brings us to a second factor that contributes to the efficient planning of our public-works programs.

Public works, by their very nature, are permanent records of stewardship, out in the open where everyone may see. Whatever may be the shortcomings of certain public officials (granting hopeful advancement in that respect), they usually are careful not to permit their incompetence to be exposed by the immutable evidence of a public-works project. Wisely, as well as fortunately, they take care to produce good work where the public has easy access to the results. For the American public are keen observers of the facilities established for their daily use and paid for by their hard-to-give-up tax money. The man on the street knows a good job when he sees it. He is not slow to express himself where he sees a fair chance to criticize. And if by chance his voice is not heeded, there is always the other political party organization, with both ears open to the voice of discontent. These are mere suggestions of a few of the many safeguards surrounding public works that tend to produce thoroughness of preparation and excellence of results. It has become established practice for such works to be projected and analyzed with a thoroughness and care not always possible on certain other projects where time, or being first in the field, is one of the elements of success. In such cases the careful advance study that has become a recognized preliminary to a public-works project has to give way to other considerations, with the almost inevitable result that the hurry-up job is in danger of waste or defect that otherwise might have been avoided.

There is also a third factor that has a strong influence on the economic stability of public-works programs. It is seldom that such projects are brought up to the stage of active construction until after public demand has shown the absolute need for the work. Except for water supply and similar undertakings, where a major factor is long-time forecasting of future needs, it is usually true that public demand is the thing that initiates the detailed studies of the project. High-pressure promotion methods are seldom brought to bear on projects of this sort. It has been true for the most part in the past that available funds have not been in evidence for all the improvements for which need has been clearly established. Even in times of prosperity, our demands for public service often get ahead of the possible construction programs, largely because of restrictions having to do with securing of majority votes, issuance of bonds and other like considerations. But during these periods when legal restrictions cause inevitable delays the engineers have the time and opportunity to perfect their plans, reconsider any doubtful features, work up alternate plans and comparative estimates, and otherwise bring the proposed work into close harmony with the needs in the case or with the funds that may be available.



Highway bridge over the Susquehanna River at Harrisburg, Pa.

Moreover, all proposed public-works projects are free targets for public comment and criticism. There is no closed season on discussion of such proposed measures. Research bureaus, taxpayers' leagues, improvement associations, chambers of commerce and the like all play their parts in offering suggestions as to the merits and defects of the proposed undertaking. Stupid indeed are those responsible for the plan who cannot find some constructive criticism among these suggestions. Often, in fact most frequently, these popular discussions eventually lead to an improvement in detail, or to an avoidance of error, which means much to the ultimate success of the project. In that respect, as in others that will suggest themselves, a public-works project has a safeguard that does not apply with equal force to similar undertakings of a private nature.

Let it be said right here that it is far from the purpose of this article to belittle the accomplishments of private enterprise. All honor to our railroad pioneers who surmounted the perils of wilderness, desert and mountain-range to furnish ready access to our Western frontiers; to our automotive engineers who have produced that outstanding example of dependable mechanism, the automobile; to those who gave us the telephone, electric lights, the radio; to our research men who are continually filling our needs, and often anticipating them, with products that frequently, until they appear, would have been considered impossible or beyond the reach of the common people; and to the hundreds of other groups, in commerce and industry, to whose ingenuity and skill we are indebted for so many contributions that have removed the drudgery from our daily routine, enabled us to conserve our time or have otherwise raised our standards of living. That story has often been told, and the evidence is before us whichever way we turn. The purpose of this article is simply to remind us that our public-works also are entitled to recognition, and that we need offer no apology either for the works themselves or for the men responsible for their design and execution.

Sewage treatment plant of the activated-sludge type at Peoria, Ill.

Other circumstances that are inseparably connected with a public-works project are the strict requirements of specifications and the close supervision during construction. Government specifications are generally recognized as being severe and inflexible. That opinion often is heard as an adverse criticism; nevertheless, when we can buy cement, or cloth, or shoes, or blankets, advertised as having been made under government specifications, we feel quite sure that we are getting quality in our purchase. Strict interpretation of specifications on public improvements undoubtedly has been carried too far in many cases, and that condition is continually being improved, but from the standpoint of the taxpayer the fault is in the right direction. Strict specifications and close supervision, which are inseparable from public improvements, give another guarantee that the work will be on a high plane. Past performance justifies the assertion that the large percentage of such projects yields full returns to taxpayers for the money expended.

It is this past record and the conditions that have associated themselves with the preparation and execution of public works that give reasonable assurance that economic considerations will continue as a controlling factor in the future.

However, there is a danger now present that cannot be ignored. An unusual problem today, standing out in bold relief, comes from unemployment and human distress. It requires resolute and conservative reasoning, under present conditions, to hold to economic standards, as against the urge to spend money regardless and thus get relief measures into action without delay. Both aims can be achieved by intelligent give and take. To swing too far in either direction would be fatal to the success of any proposed program. Regardless of the weight of present opinion brought about by emergency considerations, the inevitable reaction of public sentiment will be antagonistic to haphazard methods and wasteful expenditures. The best insurance against such results is competent planning and supervision. And past practices in this regard set a most useful precedent.

Fortunately, there are many public improvements that are already planned, lacking only available funds to permit their execution. Others are of such nature that adequate plans for them can quickly be prepared or completed. Systematic procedure, even though it gives rise to temporary impatience in certain quarters, will assure best results in the end.

The need for thorough investigations has not diminished; the urge for quick action makes it all the more imperative. Sound planning will continue to inspire confidence and to foster public pride. Never was that attitude more essential than now.

Rigid Contract Control Safeguards Public Interests

George B. Walbridge

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IN THE MAUVE DECADE it was fashionable to believe public construction to be public waste; a rhyme of those days said, "Who can doubt that the contractor did Cheops out of several millions?" Modern public-works contracting is an efficient business operation carried out with honesty and skill, as outlined here by a well-known constructor.

THE EXECUTION of public-works construction is surrounded by safeguards that have no counterpart in private-works construction. These safeguards have developed from experience and are now perpetuated in laws or in customs having virtually the force of statutory provision. In general, they apply most directly to contract construction, which is the method most practiced in public works. Ordinarily they apply only in part to work performed by direct labor. General adherence in public-works practice to construction by contract is then a safeguard. This element of safety will be considered again later on in this article.

All the elements of contractual law and practice that contribute to protection in executing public works by contract cannot be mentioned. Roughly they fall within five classifications: (1) control of bidders, (2) insurance of contracts, (3) inspection of performance, (4) guarantee of results, and (5) publicity of expenditures. Every public-works contract does not include a guarantee of results, but control of bidders, insurance of contracts, inspection of performance and publication of expenditures are elements of every contract operation. Behind all these and providing a basis for all are the engineers' plans, contract and specifications, which, as the result of careful planning, prescribe what is to be built, of what materials and how it shall be built, and what limitations of time and cost prevail, with the penalties that attach to default or non-compliance. In brief, the contractor approaches a public-works operation with a very precise definition of his obligations.

Control of bidders

Laws and ordinances governing public works require almost universally that bids shall be received openly and that the contract shall go to the lowest responsible bidder. Both requirements are obviously protective in intent and actually are protective where soundly executed. Open bidding reduces to a minimum the opportunity for collusion and secret agreements between bidders and contracting officials. Keen rivalry for work between competing bidders is a fairly certain guarantee that prejudice or favoritism cannot be patently exhibited without the action being published. There is a further curb in the fact that the lowest bid must prevail unless that bid is shown to have been made by an irresponsible bidder.

By and large the requirement that the work must go to the lowest responsible bidder is a sound safeguard of public work despite the fact that it contains possibilities of malpractice. Responsibility is capable of more than one interpretation. It may be, and popularly is interpreted to be, financial ability; or it may be interpreted to include skill in construction, possession of adequate

construction plant and organization, business integrity and a record of successful performance as well as financial ability. The latter is the engineer's interpretation, and therefore the employment of a capable public-works engineer constitutes a blanket safeguard supplementing the safeguard of the contract procedure.

The courts generally have supported the engineer's interpretation of responsibility whenever the contracting official has gone above the lowest bidder in his selection and the lowest bidder has raised question. Also they have very jealously maintained that proof of irresponsibility must be shown if they are to support award of contract to other than the low bidder. The intent of the law to get the lowest price for the public is, in general, rigidly upheld.

Responsibility is determined either by post-qualification or prequalification of bidders. Post-qualification (qualification after bidding and before award) is ordinarily limited to the lowest bidder or perhaps to the two or the three lowest bidders. It consists in determining the financial ability, credit standing, working equipment and organization, experience, performance record and general business integrity of the bidder. In prequalification this factual determination is made before the bidding and includes all bidders. Bids then are received only from those who qualify.

The methods and agencies employed to determine qualification include personal knowledge of the bidder, sworn statement by him on prepared forms containing the necessary questions, reports from commercial credit agencies, statements from the bidder's bankers and other sources familiar to business practice, including private and confidential inquiry. One of the most reliable sources of information is the Bureau of Contract Information, which possesses verified unbiased performance and credit records of some 7,000 contractors. This bureau, financed by subscribing contractors and surety-bonding companies, furnishes a fact-finding service free to anyone having contracts to let. It offers no advice or opinion; it merely presents the verified record of the contractor to the inquirer and leaves appraisal and decision entirely to the inquirer.

By these methods, whose many details and checks have been omitted, a very rigid control of bidders for public-works construction is possible and easy. The guarantee that bidders of skill, integrity and responsibility alone will undertake the taxpayers' construction is definite if the contracting agent is honest and is not interfered with in the exercise of his functions. Rectitude is common among these public agents.

Insurance of contracts

Protection in the selection of the bidder is followed in virtually all public work by insurance that the contract will be performed. This is a bond given by a private bondsman or by the bidder in the form of deposited collateral, or, as is the general practice, by a surety bonding company. This bond varies in amount of liability with the requirements of the contracting agent and in spread of liability with the statutes governing such commitments. The details are too complex for brief explanation. In broad terms the bond guarantees the performance of the contract to the extent of its liability; if the contract is defaulted through any failure of the original signer, the bondsman is called upon to take it over.

Inspection of performance

With the beginning of construction a watch is set over materials and workmanship. Inspectors, who report to the agent of the public in charge of the work, constantly check every operation to insure complete compliance with the work plans and specifications. Materials are checked for quality and condition, and workmanship for quality and finish. The inspector watches progress and warns of schedules being delayed so as to threaten the probability of completion within the contract time limit. Inspection assures the public that it is receiving in all particulars the structure that it has planned and is paying for.

Inspection in well-planned and well-designed public works is thorough and precise. This is particularly true of materials inspection. Materials are tested exactingly, and their use in the work being constructed awaits approval by test. State and city public-works departments usually maintain testing laboratories or else they employ the services of commercial testing laboratories. For some materials, as cement and fabricated steel, testing and inspection are performed at the mill. Strictly speaking, testing is more a part of engineering control than of control of contract performance, but the two functions merge, and testing calls for attention. The essential thing to be observed is not the procedure in detail but the fact that contract performance is controlled in public works.

Guaranty and accounting

Two remaining safeguards to the buyer of public works are a guarantee of completion in conformance to contract and open accounting of expenditure. Guarantee of results lies in the fact that responsible and competent bidders are selected, that the completion of the contract is insured by bond, that materials and workmanship are carefully inspected. Open accounting of expenditures is a check which the taxpayer enjoys much more completely than ordinarily does the stockholder in private operations.

Beyond the guarantee of specific checks is the fact that public-works construction has created a body of constructors who have become particularly experienced in its requirements and skilled in its performance. Long-continued programs of municipal, state and federal construction have enabled large organizations to be built up employing experienced technicians and skilled artisans and possessing elaborate plants of the most recent and improved machines for construction. Continuation of their business demands of these organizations the most careful precautions that the work reflects results that will maintain their credit and reputation as builders.

These circumstantial and somewhat elementary descriptions of specific classes of protective measures that have been adopted have seemed necessary to force home the argument of this article that, compared with the investor in private work, the citizen who pays for public works is exceedingly well safeguarded against careless or extravagant expenditure of his dollars. The contract system gives him positive definition of cost and exceptional certainty of product through control of bidders, insurance of contracts, inspection of performance, a guaranty of a finished operation and open accounting of expenditures.

It would be idle to claim that because of these protective devices no miscarriage can exist in public works. No practicably working guarantee against public or private venality has ever been devised. Some way can always be found by the untrustworthy servant to betray trust. The men selected to direct public works are in the overwhelming majority honest as well as competent; the visible quality of design and construction of all kind of public works forbids any other conclusion. Whether the expenditure has been in all cases wisely undertaken may in some cases be debatable, but the excellence of the execution of the work cannot in general be successfully disputed.

No substitute for contract construction of public works, which so securely protects the public in its expenditures, has been devised. In no substitute plan has the public so close a check upon what its delegated officials are doing. Finally the contract system is based on well-established economic principles. Its fundamental characteristics are public competition, responsibility, skill, protection of the public against losses through accidents, floods, fires and storms, guaranteed time limits, guaranteed costs, preservation of individual initiative and stimulation of the resourcefulness necessarily developed by competition. It furnishes the guarantee upon which safe financing of construction projects must rest. It develops low cost and high efficiency. It maintains for the public benefit trained organizations of specialists. It is the orderly and logical development of those sound principles upon which American business supremacy must always rest.

NEWS OF THE WEEK

Loan of $700,000 Approved by R. F. C. for Bridge Projects

A LOAN of $700,000 to the City of St. Louis, Mo., to build two railroad approaches and complete a third one to the existing municipal bridge across the Mississippi River was approved by the Reconstruction Finance Corporation on May 12. In 1918 the city completed a combined railway and highway bridge across the Mississippi to East St. Louis, but the railroad approaches were not built. In 1930 work on the approaches was begun through an agreement between the city and the Terminal Railroad Association, whereby the association agreed to supply the funds. A total of $1,300,000 was advanced but was not sufficient to complete the work and as no further money was available the city applied to the R.F.C. for the loan now authorized.

Under the agreement with the R.F.C. the Terminal Railroad Association will use the bridge to the extent that at least $100,000 in tolls will be paid to the city to apply on interest and principal of the R.F.C. loan. Receipts in excess of $100,000 will be used to pay operating expenses, estimated at $75,000 a year, and $200,000 for amortizing the Terminal Association's loan. Annual receipts in excess of this $375,000 will be used half to further reduce the R.F.C. loan and half of the Terminal Association's loan. The annual income is estimated $600,000 under full use.

Other loans approved

A loan of $100,000 to the Borough of Olyphant in Lackawanna County, Pa., for the construction of a power plant also was authorized on May 12. This is the first self-liquidating loan to Pennsylvania. The borough will rebuild an obsolete power house and install a modern turbo-generator unit.

A third loan, an addition of $19,000 to a loan authorized on March 22, was authorized to the town of Sulligent, Lamar County, Ala. The additional amount is for a water works system. The loan approved in March was for a sewer system. That loan approval has been withdrawn and a loan approval of $57,000 covering both projects has been substituted.

Loans exceed $200,000,000

Up to the first of May the Reconstruction Finance Corporation had approved 103 self-liquidating loans totaling $200,187,250.

Irrigation loan proposed

The Pease and Red River Valley Irrigation District, Texas, plans to apply to the R.F.C. for a loan to finance the construction of a dam on the Pease River near Margaret, Texas, and the construction of a canal system to irrigate approximately 500,000 acres of land in north-central Texas. The original estimates of the engineers who surveyed this project placed the cost at $7,000,000. E. R. Brown, Electra, Texas, is chairman of the local committee preparing the application.

The park board of Spokane, Wash., has applied to the Reconstruction Finance Corp. for a loan of $92,000 to complete the second municipal golf course known as the Indian Canyon Course. Overcrowding on the original municipal golf course has convinced the park board that a second course will pay for itself in ten years. The city already has done some work on the course, using unemployed men.

Housing project at Toledo

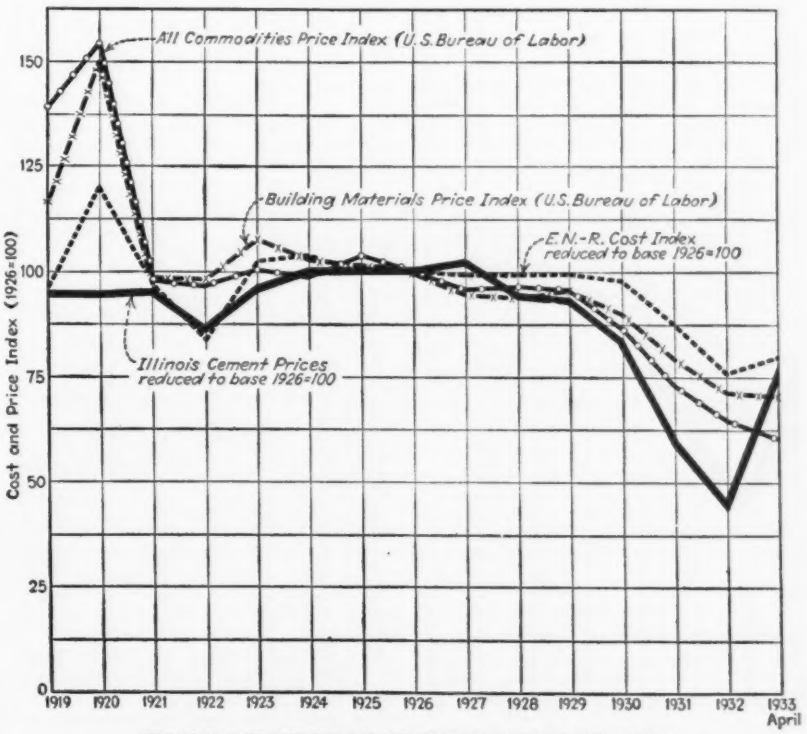
Plans for a housing development to cost about $7,000,000 in Toledo, Ohio, are being prepared for the Social Service Federation with the idea that application will be made for an R.F.C. loan as soon as the details can be worked out. The plan calls for 1,700 apartments in structures not over three stories high and covering about 13 blocks in the eighth ward of Toledo.

$35,000,000 for bridge project

The Triborough Bridge Authority, recently set up by the New York state legislature to finance completion of the Triborough Bridge at New York, is expected to apply to the Reconstruction Finance Corp. in the near future for a loan of $35,000,000. Recently Harvey Couch, director, and John L. Harrington, engineer, of the R.F.C., went over the project with members of the bridge authority and with Edward J. Byrne, chief engineer of the department of plant and structures, New York.

Illinois May Buy Cement in Open Market; Fifteen-Year Comparison of Prices

AFTER Governor Horner had rejected bids three times for Illinois highway cement requirements for 1933, the lower branch of the state legislature passed a special act on May 9 that will permit the Department of Public Works and Buildings to buy cement in the open market without calling for bids. The measure has now gone to the Senate. A provision of the bill is that with the consent of the governor the department would be permitted to purchase cement openly at not more than 90 per cent of the lowest bids rejected at a recent letting. Bids for 1933 cement requirements were thrice rejected on the ground that the bidders quoted uniform delivered



ILLINOIS CEMENT PRICES COMPARED WITH COST INDEX

A 15-year comparison of prices paid by Illinois for cement shows that cement costs were falling far below the level of commodity prices during the past two years, while this year's quotations reverse the trend and return to the general commodity level.

prices and because all bids were much higher than those quoted in 1931 and 1932. The state attempted to lease a cement mill and manufacture its own product for this year but the cement companies refused to consider such an offer.

A fifteen-year comparison of prices paid by the state for cement shows that the low prices of 1931 and 1932 were abnormal. Prices paid from 1919 to 1932, inclusive, and bid quotations for 1933 are as follows, based on average delivery price to county seats, allowance for bags and discount being deducted: 1919, $2.04; 1920, $2.03; 1921, $2.04; 1922, $1.86; 1923, $2.06; 1924, $2.15; 1925, $2.15; 1926, $2.15; 1927, $2.20; 1928, $2.00; 1929, $1.98; 1930, $1.78; 1931, $1.29; 1932, $1.94; 1933, (bid) $1.62.

These prices, reduced to a basis of 1926 equals 100, are compared in the accompanying illustration with the *ENR* construction cost index, also reduced to 1926 equals 100, the U. S. Bureau of Labor general commodities price index and the Bureau's building materials cost index. In the years 1919 and 1920 particularly, and on to 1924, cement prices were far below the price index of general commodities and building materials. During the next seven years the cement prices agreed closely with the indexes, going down with them in 1929 and 1930. But the bitter price war of the last two years brought cement far below the cost of commodities and building materials. The 1933 bids again return to the range of the indexes. It should be noted that the latter are themselves based on market prices that in many cases are at or below production cost. Further, the commodity indexes apply only to April, 1933, while the Illinois cement bids apply to the entire delivery period of the current year and must remain in force despite inflation and resulting increased cost of manufacture.

Proof that the 1931 and '32 prices were abnormal is found in the fact that published financial statements of eleven cement companies show losses of $10,039,000 for 1932. In 1931 three of these companies reported profits totaling $1,909,523, while the other eight reported losses aggregating $3,998,696.

Columbus to Call Public Bids For Disposal of City's Sewage

The city of Columbus, Ohio, is completing the details of a form of contract under which private corporations will be asked to bid upon the disposal of the city's sewage over a period of 15 years.

Under the proposed form of contract the successful bidder will design, finance and construct the plant on land leased from the city. He will put up a surety bond equal to one year's payment by the city, about $250,000, and will provide purification to meet the requirements of the state department of health. Provision is made for a bonus for purification above the standard and for deductions for days when the effluent is below standard.

Payment is to be made on the basis of an estimated delivery of 35,000,000 gal. a day with provision for minimum payment in case the city fails to deliver sewage through a breakdown of the pumps or other cause.

The city has been ordered by the Ohio Health Council to end the pollution now caused by inadequate treatment of its sewage.

Award Made on 50,000 bbl. Bid for Hoover Dam Special Cement

The Bureau of Reclamation has awarded a contract for 50,000 bbl. of special cement for Hoover Dam to the Union Portland Cement Co., Salt Lake, for $1.39 f.o.b. Devils Slide, Utah. Bids were asked for recently on 400,000 bbl. of special low-heat cement. Except for the $1.39 quotation of the Union Portland Cement Co. on 50,000 bbl., all other bids were $1.55. They were rejected by the Secretary of the Interior as being too high.

New bids for additional requirements were asked for on May 17, the specifications being somewhat revised from those of the previous call for bids. The time of initial set and determination of initial set has been made the same as for standard federal specifications, being reduced to 1 hour from a previous requirement of 1½ hours. The required compressive strength has been reduced from 1,000 lb. per sq. in. to 800 lb. at the end of seven days; and from 2,400 lb. to 2,000 lb. at the end of 28 days. A schedule showing prorating of proposed shipments from different mills of companies submitting a combined bid is requested.

Seattle Again Rejects Bids on Extension of Power Project

Bids received for the $4,000,000 construction and financing program of the light department of the city of Seattle on May 10 had been returned unopened on the recommendation of J. D. Ross, superintendent of the department. This is the second time the city has not acted on the bids received. Under the call for bids the contractor was to accept pay in city-light bonds for new construction work and to take city-light bonds in return for money provided to finance equipment ordered by the city.

A survey of the Skagit River hydroelectric power development and other units of the municipal light and power system by a firm of nationally-known engineers has been approved by the utilities and finance committee of the city counsel of Seattle, following a recommendation made by Mr. Ross who is in Washington negotiating with R.F.C. officials for a loan. The financial set-up of the light department recently was audited as a preliminary to the loan application.

R.F.C. Loan to Southern Pacific for New Terminal at Houston

Included in a loan to the Southern Pacific Co., recently approved by the Interstate Commerce Commission, is $1,200,000 to cover the railroad company's share of the cost of the new passenger station at Houston, Texas. The city already has spent more than $1,000,000 in closing of streets and in construction work connected with the project.

The railroad company will build a four-story fireproof station and a passenger subway serving a ten-track station yard.

The station and auxiliary structures are to be let by contract and the track work will be done by the company's own forces or by contract, whichever is found to be more economical.

Florida Legislature Creates Body to Plan Canal Across the State

Both houses of the legislature of the state of Florida have passed a bill establishing the state ship canal authority in order to set in motion the machinery whereby the state may borrow money from the Reconstruction Finance Corporation for the construction of a canal from the Atlantic Ocean across to the Gulf of Mexico. Construction of a canal has been actively promoted for several months.

The measure authorizing the governor to appoint the ship canal authority does not definitely state whether the canal is for barges or for ships and it does not fix the route. The cost is estimated at $118,000,000.

Governor Horner of Illinois Seeks Out Needed Public Work

Not many R.F.C. projects have come from Illinois and fewer still have obtained any money, but with the prospective liberalization of the relief act Gov. Henry Horner visualizes much needed work that should be done in the public interest and can probably qualify.

One of the governor's first appointments upon taking office was a committee on unemployment, headed by Harry Wheeler, retired vice-president of the First National Bank, Chicago. One task of the committee was to find and suggest to the governor meritorious public-works projects the construction of which he might expedite either through state enabling legislation or through assistance from the R.F.C. For the latter it was thought that if the public works of the state were presented to the R.F.C. by committee acting under the governor's authority it was likely that a larger number would be approved by the R.F.C. than if the various communities themselves were compelled to make individual representation to the federal authorities and much of the delay heretofore encountered by the officials of the individual municipalities would be eliminated. This follows closely the method pursued by New York, Ohio and Michigan.

These projects are selected from the list made up by the Trade Recovery Committee since each has been especially looked into thoroughly by the unemployment committee. The engineering features of the projects already have been passed on by the engineers of the governor's committee or by engineers of some of the state departments.

Due to a widespread reticence on the part of officials to inaugurate public-works projects the Governor on May 4 issued a statement quoting the committee recommendation of the desirability of "an extensive development of needed public works." He requested political subdivisions to "communicate with this committee presenting in full, information regarding possible public projects, plans for which have already been drawn up, or projects which are sound and desirable even though not yet planned and financed."

Some of the projects, the governor hopes, can be conducted in part at least out of relief funds of the state, thus lowering costs through the application of work relief wherever possible.

The office of the committee on unemployment is 38 So. Dearborn St., Chicago.

Use of Rail Tunnel and Bridge for Pittsburgh Road Endorsed

Proposed purchase of the Wabash Railroad bridge and tunnel by Allegheny County, Pittsburgh, Pa., to provide a new highway route to South Hills, has been approved by Ole Singstad, consulting engineer, New York, following a study made at the request of the county commissioners. The proposal has been before the commission for about two years. Mr. Singstad reported that the price of $3,000,000 for the two structures asked by the railroad company was reasonable and stated that about $1,300,000 would be required to convert them to highway use. He advised construction of a second tunnel to make the highway adequate for four-lane traffic instead of two-lane as would be possible with the present tunnel. This would add $2,000,000 to the cost.

The county hopes to have the project included in those to be financed under the pending federal public-works program.

Renewal of Home Building Discussed at Chicago Meeting

Deferred building of 500,000 homes, amounting to $3,000,000,000 by the end of 1933, is the estimate of the U. S. Department of Commerce from a recent survey of 300 cities, so James S. Taylor, chief of the division of building and housing, told the 300 leaders of the construction and allied interests assembled for the National Conference on the Renewal of Home Building May 9 and 10 in Chicago. He based this statement on the number of homes that should normally have been built in the last 3½ years. The demand is for homes costing under $5,000, including the lot.

Significant conclusions brought out at the conference are that taxes on real estate are expected to be reduced by one-fourth; the home loan banks will loan money directly to the owner on easier terms; trends are toward small homes on miniature farms at the outskirts of cities thus making the owner less subject to depression factors; the normal rate of building will be resumed slowly and will reach a normal peak in 1938. While many novel materials and methods were described there seemed to be a feeling that none compared in cost with those generally in use. Air conditioning awaits better insulation.

John Millar of Millar's *Housing Letter* stated that various agencies had indications within the last month of a decided upturn in inquiries and business. Many inquirers had cash to pay in full. The Portland Cement Association's recent mailing of 71,000 circulars advertising a low-cost fireproof house has drawn 6,600 inquiries from the trade. The Architects Small House Service Bureau, Inc. reports that the recent showing of the design of a 4-room house in metropolitan newspapers brought ten times as many inquiries as are normally received from notices of 5- and 6-room houses.

Predictions were made of early rises in price of building material. Construction costs are now 9 per cent above 1913 for all items except land. Roy W. Wenzlick, economist and vice-president, Real Estate Analysts, Inc., St. Louis, said that in that city there are 32,000 residential vacancies.

Court Rejects First Damage Suit Over Water Tunnel at Detroit

An opinion of no cause for action against the city of Detroit has been handed down by the Wayne County Circuit Court at Detroit, the first case heard of over 100 damage suits filed as the result of construction of the Ford Motor Company's water tunnel in that city. The suit was brought against the Ford Motor Co., the city of Detroit and Stephen A. Healy, doing business as the Healy Construction Co., for damages of $30,000 to property fronting on Dearborn Ave., claimed to have been insured by settlement due to the construction of the tunnel.

The Ford tunnel under Dearborn Ave. has an exterior diameter of 21 ft., an outer shell consisting of interlocking concrete blocks 8 in. thick and an inner shell of 18 in. of poured concrete. Dearborn Ave. is 66 ft. wide and the house in question is 22 ft. back from the property line and 55 ft. from the center line of the street and tunnel. Under the surface is a layer of 15 to 17 ft. of loam which rests on the hard blue clay through which the tunnel was driven by the shield method.

The plaintiff claimed that the defendant had not taken the necessary precautions to prevent the flow of material into the excavation, that seepage through the joints in the concrete blocks before the inner lining was placed had carried sand into the tunnel and had caused settlement and that the driving of the tunnel had caused earth movement.

The court held that the claim for damage to a superstructure by reason of excavation on adjacent land must be predicated upon a showing of negligence in making the excavation and that the claim for negligence in this case narrowed down to one specific allegation, namely, that there was a failure on the part of the defendant to install an inner lining with the degree of promptness which due care required, and that in the 90 day period allowed, seepage of water from the surrounding soil through the spaces between the concrete blocks resulted in the removal of supporting water in the soil under the plaintiff's house causing the land to subside. The preponderance of evidence, the court held, was to the effect that clay is impervious and that it would be physically impossible for water to have seeped between the concrete blocks from the surrounding soil; that the method of excavation was in accordance with most approved engineering practice, and was skillfully performed without hint of negligence.

The judgment of no cause of action against the City of Detroit was returned because of failure of the plaintiff to follow the mandatory provisions of the city charter in filing claim against the city before starting suit, but the court's finding as to the construction work is expected to have a deterrent effect upon the pending suits.

Engineer Awarded Hero Medal For Attempted Rescue at Lima

Posthumously, Earl I. Roberts has been honored by the Carnegie Hero Fund Commission with a medal for giving his life, May 4, 1932, in a heroic but futile attempt to rescue a plant operator from a manhole alongside one of the digesters of the sewage treatment works at Lima, Ohio. Mr. Roberts was assistant engineer for H. P. Jones & Company, Toledo. As stated in an editorial of the *Toledo Blade*, "Mr. Roberts, a highly trained engineer, was well aware of the hazard he assumed for his fellows. He knew the possible cost of his heroism but did not stop for a moment to reckon it. The chastely engraved silver disc has little intrinsic worth, but it was not minted of money. It is of the coinage of faith,—a token of high human values."

MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS BUILDING

Early in May the Department of Public Works of the State of Massachusetts began moving into its new building on Nashua St. in Boston. The structure is 93x358 ft. in plan, ten stories and basement, of structural steel faced with stone. It cost $1,600,000, including the land.

The testing laboratories of the state highway department are to be located in the basement, the first, second and third floors are to be occupied by the motor vehicle department, main offices of the public works department will be on the fourth floor and the engineering offices will occupy the fifth, sixth and seventh floors. The remaining floors will be used by other departments.

Contract for construction of the building was let in Decemeber 1931 to F. V. Warren Co., Philadelphia. A. W. Dean is chief engineer of the department of public works and Edward T. P. Graham, Boston, was architect of the building. The work was carried on under the direction of E. N. Hutchins, engineer in charge.

Court Holds Rates Must Be Responsive To New Conditions

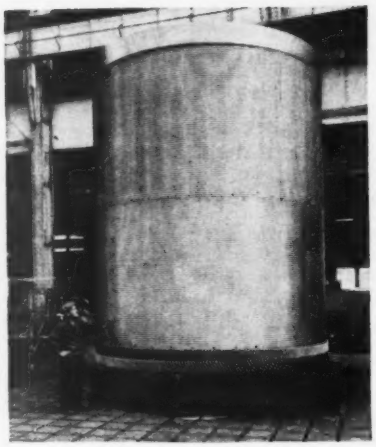
THE rate of return upon the investment in a public utility must reflect changes in general business conditions, according to a finding of the United States Supreme Court in a decision rendered May 8, upholding the California Railroad Commission in reducing the rate which the Los Angeles Gas & Electric Corp. may charge for gas. The court in its decision cited its earlier decision in the Bluefield Water Works *vs.* Public Service Commission in which it said that a "public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally made at the same time and in the same general part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties; but it has no constitutional right to profits such as are realized or anticipated in highly profitable enterprises or speculative ventures. The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties. A rate of return may be reasonable at one time and become too high or too low by changes affecting the opportunity for investment, the money market and business conditions generally."

Commission findings

The case under consideration by the court related only to the gas properties of the Corporation. The rate base for its gas department, as fixed by the California commission at various times since 1917, grew from about $12,500,000 in 1916 to about $59,000,000 in 1929. Under the commission's order of 1928, the gas rates were estimated to yield a return slightly in excess of 7.5 per cent. Concluding that these rates actually yielded a much higher return, the commission, in November, 1930, reduced the rate by the order under review, which was intended to effect a reduction of 9 per cent in gross revenue, about $1,300,000, or $1,080,000 in net revenue.

In determining the rate base, the commission made two sorts of valuations of the gas properties for the year 1930, one of $60,704,000 on the basis of "historical cost," and the other of $65,500,000 on the basis of "fair value." The commission estimated that the return to the company on the former basis would be 7.7 per cent; on the latter, 7 per cent. In determining the historical cost, the commission made no deductions for the investment in the generating plant and equipment which it found were being rendered unnecessary by the introduction of natural gas, the book value of which was about $10,000,000. This was done because the commission found that the investment in manufactured plant had been made prudently and in good faith.

The company claimed before the commission a rate base of approximately $95,000,000 on the basis of reproduction costs new as of Jan. 1, 1930, less accrued depreciation. On comparing the company's estimates as of that date with the estimate of the commission's engineer, of reproduction costs new, in each case without deductions for depreciation, the court said that it "appears that the difference, exclusive of overhead and the items mentioned below, was only about $3,000,000 in the valuation of the physical property. In its estimate the company included overhead at 24.27 per cent, or a total of $14,990,278. On that basis, the value of the physical property was estimated by the company, without depreciation, at $76,754,919. This included $12,134,665 as the reproduction value of the standby manufacturing facilities. The company's witness testified before the commission that in his estimate of reproduction cost he had attempted to obtain prices that would be reasonably stable and might prevail over the next three years; that the prices used were very close to the average of those which prevailed for a three-year period prior to Jan. 1, 1930; and while in his opinion there was a temporary slump in prices, he did not think it probable that there would be any substantial change within the next two or three years."



DRUM FOR HOOVER DAM CABLEWAYS

Two hoist drums, the largest ever built, recently have been completed for the 150-ton cableway for Hoover Dam. Each drum is rolled from steel plates 2 in. thick, 42 ft. long and 8 ft. wide. They weigh 90,000 lb. apiece and will be wound with more than a mile of 1⅛ in. wire rope. Electric welding was employed extensively in the fabrication of the drums.

In arriving at its total estimate of reproduction costs new, the company added to its valuation of its physical property items of cost of financing, $5,921,470; promoter's remuneration, $2,500,000; going concern value, $9,228,667. These items the commission did not allow on the basis that the cost of financing and the promoter's profits were too hypothetical and far removed from actuality properly to find lodgment in a rate base and that the going concern value was determined on unacceptable theories and assumptions. The result is, said the court, that the commission allowed for the year 1930, as a basis for its calculation of return, a valuation of $65,500,000 without deduction for depreciation.

Determination of confiscation

In commenting generally upon the case the court said, "We do not sit as a board of revision . . . the judicial function does not go beyond the decision of the constitutional question. That question is whether the rates as fixed are confiscatory. And upon that question the complainant has the burden of proof and the court may not interfere with the exercise of the state's authority unless confiscation is clearly established . . . This court has repeatedly held that the basis of calculation of the fair value of the property is a fair return upon the reasonable value of the property at the time it is being used for the public . . . and mindful of its distinctive function in the enforcement of constitutional rights, the court has refused to be bound by any artificial rule or formula which changed conditions might upset.

"The actual cost of the property is a relevant fact, but while costs must be considered, the court has held that it is not an exclusive or final test. The public has not underwritten the investment. The property, on any admissible standard of present value, may be worth more or less than it actually cost . . . This court has further declared that in order to determine present value, the cost of reproducing the property is a relevant fact which should have appropriate consideration . . . But again, the court has not decided that the cost of reproduction furnishes an exclusive test."

Cost of reproduction

After discussing details of method used in determining the present value, the court said: "The determination of present value is not an end in itself. Its purpose is to afford ground for prediction as to the future. It is to make possible an intelligent forecast of probable future values in order that the validity of rates for the future may be determined . . . We know that the estimates of present value, taken as the cost of reproduction as of Dec. 31, 1929, based upon average prices of 1926 or 1927 to 1929, furnish no dependable criterion of values in the succeeding years. The country was facing a most serious decline in prices. It was entering upon a period of such depression as to constitute 'a new experience to the present generation.' It was not the usual case of possible fluctuating conditions, but a change in economic level . . . It is apparent that the estimates of cost of reproduction new of 1929 or of 1930, upon which the company relies, afford no secure foundation for prediction of future values, and the rate base as fixed by the commission is not to be invalidated as involving confiscation by reason of these estimates, which the course of events deprived of credit as trustworthy prophecies.

"Our conclusion is that the company has failed to sustain its attack upon the rate base of $65,000,000 . . . The commission calculated that the company would have a return of 7 per cent on this rate base . . . Applying these principles (those previously cited in the Bluefield Waterworks and other decisions of the court), we find it impossible to hold that a return of 7 per cent is so low as to be confiscatory."

Included in the decision is a long discussion of going concern value, allowance for depreciation and overhead.

Justice Butler rendered a dissenting decision in which Justice Sunderland concurred. He expressed the view that the commission had not applied the principles of valuation laid down by the Supreme Court in earlier decisions.

Public Works of $117,500,000 Found Available in Michigan

Public works in Michigan that could be put under construction in the near future if financing is provided by the federal government, as proposed in the pending federal public works legislation, total $117,500,000, according to figures compiled by the Michigan Committee for Trade Recovery. The general classifications are as follows:

Roads	$25,000,000
Sewers and disposal plants	20,000,000
Water works	5,000,000
Flood control and drainage	10,000,000
Grade crossings	15,000,000
Schools and institutions	24,000,000
Incinerators, etc.	3,500,000
River work	5,000,000
Recreational facilities	5,000,000
Total	$117,500,000

Contract Let for Steel Pipe for Water Line at Seattle

Contingent upon the approval of the Reconstruction Finance Corporation, the board of public works of Seattle, Wash. has awarded to the Puget Sound Machinery Depot a $373,323 contract for furnishing and laying 25,800 ft. of 78-in. cement-coated steel pipe between Grouse Ridge and Lake Youngs. The pipe will replace lines No. 1 and 2 of the old Cedar River pipe line. It will be $\frac{5}{16}$ in. thick, covered with a coating of cement, $\frac{1}{2}$ inch thick in which wire mesh is embedded.

Subsequent to the announcement of the tentative award of the contract, it was announced that the Cement-Wrapped Pipe Company, Ltd., would erect a plant in Seattle costing about $40,000 for the manufacture of the pipe. The plant is expected to be a permanent one for the manufacture of similar pipe or other allied operations such as cement-coated piles.

Permanent Advance Planning Proposed in Pennsylvania

A bill providing for six-year advance planning of public works by the state, cities and principal counties was passed by the Pennsylvania legislature before its adjournment and is now before the Governor for his approval. The bill creates a state public works planning board to formulate annually a six-year comprehensive plan and financial program on state public works in order to promote greater economy in construction and to make it possible to conserve the public credit for use in periods of depression.

The bill is based on the federal legislation creating the federal employment stabilization board. It requires that each state department having charge of construction of public works plan and program its proposed projects six years in advance, and prepare detailed plans and specifications at least one year in advance. It requires further that an advisory opinion of the state board accompany requests to the legislature for appropriations for proposed capital public works. For the cities and principal counties the bill provides that where local boards are not set up within two and one-half years, the state board must give an advisory opinion upon capital expenditures for public works before the voters are asked to authorize the borrowing of money.

SOCIETY CALENDAR

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual convention, Chicago, June 27-30.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Chicago, June 26-30.

AMERICAN WATERWORKS ASSOCIATION, annual meeting, Chicago, June 12-16.

NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS, annual convention, Chicago, June 26-28, 1933.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, annual meeting, Chicago, June 27-30.

ENGINEERS WEEK, Century of Progress Exposition, Chicago, June 25-30.

SMOKE PREVENTION ASSOCIATION will hold its 27th annual convention in Chicago June 20-23.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS will hold its 6th annual meeting at the Commodore Hotel, New York City, May 20.

MICHIGAN ENGINEERING COUNCIL will meet at the Hotel Olds, Lansing, Mich., on May 20.

THE DETROIT ENGINEERING SOCIETY, at its recent annual meeting, elected the following officers: H. L. Walton, president; H. S. Ellington and J. H. Hunt, vice-presidents and Arthur B. Morrill, secretary-treasurer. E. L. Brandt was reappointed managing secretary.

Housing Project for Jersey City

Construction of a $3,500,000 housing project on twelve acres of land, bounded by Henderson, York and Warren streets and Railroad Avenue in Jersey City, is being considered by a committee recently named by the mayor. Hugh H. Kelly, of Jersey City is architect and engineer for the committee. If the project is considered feasible an R.F.C. loan will be sought.

Engineers Appointed in Missouri To Seek Out Public Works

Governor Park of Missouri has appointed a commission of five members to conduct a state-wide survey to determine what public works within the state may be undertaken under the pending federal public works program. E. M. Stayton, street railway commissioner of Kansas City, is to be chairman of the commission and the other members a Baxter L. Brown and A. P. Greensfelder, of St. Louis; T. H. Cutler, chief engineer of the Missouri State Highway Department, and Prof. Walter Burr, of Missouri University.

Postponement of Crossing Work Authorized in New York State

The public service commission and the transit commission of New York state are authorized under a law passed at the recent session of the state legislature, to postpone the operation of orders requiring the elimination of existing highway-railroad crossings at grade or the alteration of existing structures. The provision has been written into the law in order to relieve railroad companies during the present economic emergency from the necessity of proceeding with grade-crossing elimination work. It does not apply to projects covered by special laws, or projects on which work has been commenced or contracts let.

Brief News

TUNNEL No. 5 on the Owyhee irrigation project, a 4½-mile tunnel, the longest on the project, has been completed after three years work. No lives were lost and no serious injuries occurred during the construction of the tunnel.

PURCHASE of the privately-owned water supply system of Bath, Maine, is being considered by the village trustee. It is believed that considerable saving can be made to the community by buying the plant and modernizing the present equipment.

NEGOTIATIONS FOR THE PURCHASE of land for the 15,000-acre recreation lake in South and Carter Counties in Oklahoma, recently authorized by the state legislature, are expected to be begun in the near future. The legislature provided $90,000 for the project.

AN AWARD OF $71,556 for extra work done for the city of Tacoma, Wash., on the Cushman power dam No. 2, on Lake Cushman, has been awarded to L. B. Hoffman, contractor of Portland, Ore., by the federal court at Tacoma. Mr. Hoffman sued for $236,436. The verdict was returned after five weeks of litigation. It is expected that the city will appeal the decision.

CANALIZATION of the Beaver and Mahoning River valleys to give the steel industries of the Mahoning valley the advantage of low water rates, a proposal that has been actively agitated before the rivers and harbors committee in Congress despite an adverse report by the Army engineers, will not be included in the Rivers and Harbors bill this year, according to Washington reports.

CONSTRUCTION OF TRUNK SEWERS in the Muddy Creek and Bloody Run valleys at Cincinnati, Ohio, as proposed by the county sanitary engineer, J. S. Rafferty, has been advanced to the point where the finance committee of the city council has ordered a final report. The work is estimated to cost $625,000. Of this amount, $300,000 would be required for labor and it is expected that it can be obtained from R.F.C. funds provided for relief work.

A COMPROMISE FOR $36,701 has been agreed upon by attorneys in the suit of R. J. Lynch & Co. against the State Highway Department of Arkansas for $53,105, one of numerous suits growing out of the invalidation of highway contracts let without formal calls for bids. The state supreme court has ruled that the contractors must be paid a fair value of the work performed. Among the items rejected was $6,144 for profits.

DETERMINATION of the amount of pollution in the Mississippi River below Minneapolis and St. Paul has been begun by the state board of health as a preliminary to the start of work on the proposed sewage disposal plant for the Twin Cities. Formation of the sanitary district for the two cities, recently authorized by the state legislature, cannot be undertaken until the board of health orders the city to reduce the pollution of the river because it has become a menace to health.

Personal Notes

FRANKLIN D. HOWELL, formerly general manager of the Motor Transport Co., resigned that position and has opened an office as consulting engineer in the Pacific Electric Building, Los Angeles, Calif.

LYNN L. DAVIS, resident engineer, U. S. Engineer Office, Oswego, N. Y., has been transferred to the District Engineer office at Buffalo, effective June 1. Mr. Davis came to the Oswego office from Buffalo about a year ago.

J. L. LYTEL has established an office as a consulting engineer in the Securities Building, Seattle, Wash. During the past five years Mr. Lytel was construction manager with the United Engineers & Constructors, Inc., and with Dwight P. Robinson Co., of Argentine in charge of the Lacroze subway in Buenos Aires. Previous to that time he was with the Bureau of Reclamation for 23 years as construction engineer and project manager.

Obituary

JOHN H. DUNLAP, bridge engineer for King County, Washington, for the past 16 years, died in his home in Seattle recently, age 75 years.

ARTHUR P. WOOD, one of the engineers who built the Union Pacific Railroad, died at his home in Omaha, Neb., on May 2, age 96 years. He was a graduate of the University of Michigan.

RAYMOND DUPUY, former president of the Virginian Railroad, died at Palm Beach, Fla., on May 14, age 73 years. Mr. DuPuy studied engineering at Georgetown University; upon graduation became an assistant engineer with the Missouri, Kansas & Texas Railway and continued in railroad service from that time. He retired as president of the Virginian in 1918.

DABNEY H. MAURY, consulting engineer, retired, died at his home at Chevy Chase, Maryland, on May 11. Mr. Maury, formerly of the firm of Maury & Gordon, consulting engineers, Chicago, retired from active service in 1927 and moved to Washington to live. Mr. Maury was born in Vicksburg, Miss., in 1863 and graduated from the Virginia Military Institute in 1882 and from Stevens Institute of Technology in 1884. His early work was in railroad construction both in this country and in Central America, but in later years he specialized in water supply work. During the World War Mr. Maury served as a lieutenant colonel in the construction division of the army.

CHARLES T. WATSON, retired, former engineer of the federal government, died at his home in St. Louis, Mo. May 12, age 68 years. Mr. Watson was a graduate of the school of engineering of Missouri University. His early engineering work was in Central and South America.

Engineering Contracts and Capital

HEAVY engineering construction is practically at a standstill throughout the country pending consummation of the public works program. Contracts reported for the past week total only $7,694,000, the lowest weekly figure in years except for the week of the bank holiday, when a slightly lower total was reported. Federal contracts let during the past week amounted to only $141,000, showing the effect of the Administration's order holding off on award of contracts. State and municipal awards, likewise affected by the delay awaiting the public works program, totaled $4,399,000. All public works reported last week amounted to $4,540,000. Private awards also were lower than usual, aggregating $3,154,000. The average of private contracts let the last four weeks is $4,774,000. All contracts have averaged $20,463,000, a figure still showing the effects of the $54,000,000 total reported two weeks ago. Last year contracts averaged $26,936,000 per week in May. Cumulative contracts to date this year total $333,630,000, as compared with $452,593,000 for the same period last year. The largest contract reported last week was that for Missouri highways, aggregating $1,239,000.

Large projects announced as being in the planning stage include schools at San Francisco to replace those considered as a fire menace, $3,500,000; electric plant, Toledo, $2,500,000; brewery extensions, Los Angeles, $1,000,000; federal court house, Kansas City, $2,800,000; buildings, Louisiana State University, Baton Rouge, $1,777,000; and a housing project in Cleveland, $5,000,000.

New productive capital issues reported sold during the week total $11,703,000, including an advance of $360,000 by the R.F.C. to the Middle Rio Grande Conservancy District on a previously committed loan. No private capital issues were reported. Productive capital issues for the year to date total $113,377,000, as compared with $331,000,000 for 1932.

Contracts and Capital

CONSTRUCTION
(Thousands of Dollars)

	Weekly May, 1932	Average Four Weeks	Week May 18 1933
Federal government..	$6,530	$948	$141
State and municipal..	13,160	14,741	4,399
Total public.....	$19,510	15,689	$4,540
Total private.....	7,426	4,774	3,154
Week's total.....	$26,936	$20,463	$7,694

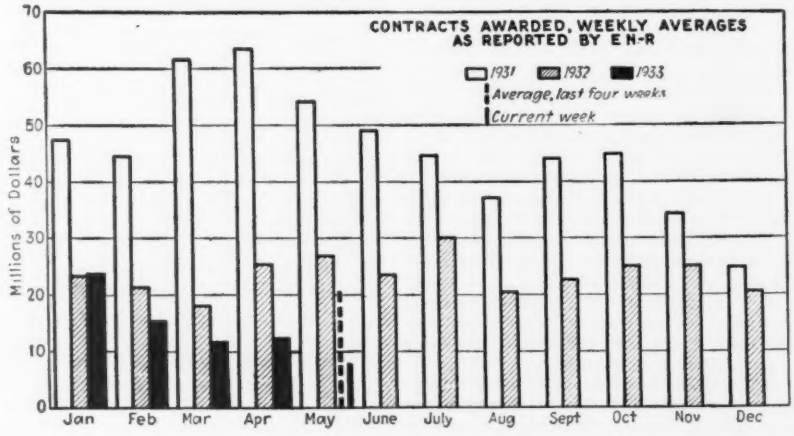
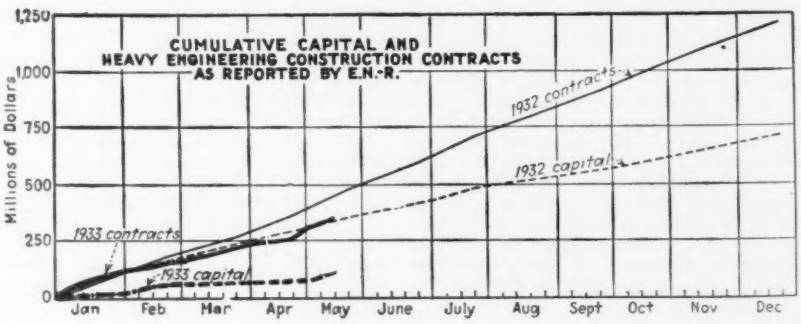
Cumulative to date:
1932..... $452,593
1933..... 333,630

NEW PRODUCTIVE CAPITAL
(Thousands of Dollars)

	Weekly May, 1932	Average Four Weeks	Week May 13 1933
New capital issues....	$18,000	$10,544	$11,703

Cumulative to date:
1932..... $331,000
1933..... 113,377

R.F.C. self-liquidating loans:
Approved current week..... .....
Approved to date (including 1932)..... $204,682
Actual loans made (including 1932)..... 46,618

ENR Cost and Volume Index

E.N.-R. Cost		E.N.-R. Volume	
May, 1933.....	**164.39**	**April, 1933**.....	**65**
April, 1933.....	160.16	March, 1933.....	62
May, 1932.....	152.78	April, 1932.....	135
1932 (Average)...	156.97	1932 (Average).....	127
1931 (Average)...	181.35	1931 (Average).....	220
1930 (Average)...	202.35	1930 (Average).....	260
1913 Average.....	100